Royal Show Review

Weed Control

WORLD CROPS

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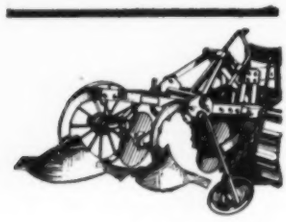
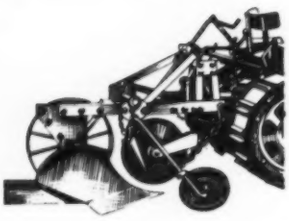
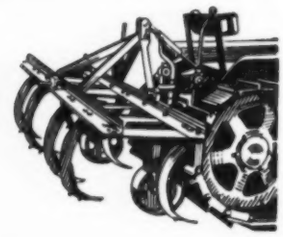
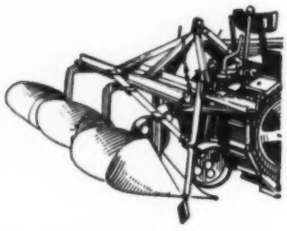
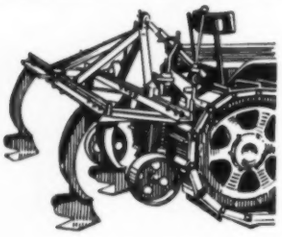
A Ransomes Cropguard spraying permanent pasture with 'Agroxone' at 5 pints to the acre.
(Plant Protection photograph)











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Editorial Comment

Hormones as weedkillers

THE MARKED rise in out-turn from British farms over the past 20 years has been due to a number of factors, including a generally improved standard of farming, heavier applications of artificial fertilisers, mechanisation, advances made in the control of pests and fungus diseases and the increasing use of herbicides.

Chemical weedkillers now used fall into two groups, non-selective and selective, although this designation is comparative only, and it would be more correct to describe the groups as less and more selective. The herbicides of the latter group are organic substances which have resulted from close botanical and chemical research and they may kill by contact where they touch or kill as growth regulators. These last are the hormone herbicides.

The substances originally used as weedkillers were of a simple chemical nature. Between the two world wars great advances were made in chemical industry and one result was that plant poisons were studied and developed. The well-known herbicide, ' Sinox ', or DNC, sodium di-nitro-ortho-cresylate, was developed in France in 1933, followed by Dinoseb, di-nitro-secondary-butyl-phenol. DNC is effective at the rate of 6 to 10 lb. per acre, whilst, with Dinoseb, only 1 lb is needed. These newer plant poisons are far more effective; they take advantage of the fact that a plant may not be equally sensitive to a poison throughout its life and that there may be physiological crises (*e.g.* the onset of flowering) when it is more susceptible to treatment.

However, a third phase in weed control has since been developed whereby a group of complex organic substances related to the growth-promoting compounds occurring naturally in plants – the plant hormones – are employed. A natural hormone is not primarily a plant poison, but certain modifications can over-stimulate and upset some vital process and cause the plant to die. They are, however, non-poisonous to animals and highly selective in the type of plants they affect. As early as 1936 it was recorded that alpha-naphthyl acetic acid, ANA, at 10 parts per million was beneficial to plants, but that at 100 to 1,000 p.p.m. it over-stimulated to produce abnormally rapid growth and then death.

Very soon cheaper substances were discovered and during the war two highly successful weedkillers of the growth regulator type were produced. One of these, 2-methyl, 4-chloro-phenoxy-acetic acid, spoken of as MCPA, was made and used largely in Britain. The other, 2-4-di-chloro-phenoxy-acetic acid, now well known as 2,4-D, was developed in the U.S.A. These substances have a remarkable control over the weeds in cereal crops when applied at the rate of 1 lb. per acre. Many similar compounds have been tried out, but MCPA and 2,4-D are still the most satisfactory.

Hormone herbicides, however, also have their limitations, since they affect all plants, both crops and weeds. Their selectiveness lies in differing degrees of action. Thus wheat and barley are safe at a certain rate of application provided the plants have reached the six-leaf stage. It must be recognised that weeds not killed by these or other herbicides flourish better as their competitors are eliminated. Broad-leaved crops, such as clover, lucerne and peas, are destroyed by MCPA and 2,4-D.

A herbicide that will kill all weeds and spare all economic crops is not likely to be found, but research goes on and Sir E. John Russell, in a masterly article entitled ' Weeds: The Ancient Enemy ', published in *Agriculture* in April, states that more than 10,000 scientific papers have been published on the subject of herbicides in the past five years.

The losses suffered in agriculture through weed growth are difficult to assess, but less than five years ago it was estimated that in all Britain's crops some 10% by area was occupied by weeds. Corn was reckoned to lose 3 cwt. per acre from weed competition and the crop might be increased 20% by complete weed suppression. In grasslands it was considered that 30% of the pasture was weed which reduces the nutritive value of the product.

In the light of these estimates, we are glad to learn that large areas of cereals, grass and other crops in Britain and vast areas in the U.S.A. and Canada are being sprayed with hormone herbicides. Increasingly large areas are also dealt with in Australia, New Zealand and South and East Africa. The application of herbicides has indeed become a major factor in modern farming.

The market for sprayers and dusters

SMALLHOLDERS PRODUCE about three-quarters of the world's cocoa, half the natural rubber, 90% of the rice, besides considerable quantities of other products. In addition, practically all food required for home consumption is grown by the peasants themselves. Yields from smallholdings are, however, much lower than those obtained on large properties because the smallholder has little or no capital and cannot afford expensive fertilisers, fungicides, herbicides and insecticides, or the apparatus for applying them. Without aid, therefore, he is powerless to resist the effects of epidemics and, if faced with persistent difficulties, may abandon cultivation of export crops and depend

entirely on subsistence farming. It is evident that, if means can be found to make modern equipment available to him, his economic position would be improved and world production increased.

The wide range of cheap sprayers and dusters displayed at the recent CROP PROTECTION AND PEST CONTROL EXHIBITION showed that manufacturers are aware that sales of such apparatus might be considerably extended. Hand sprayers and dusters have already found favour in some regions – in West African cocoa smallholdings, for instance—and we are convinced that further opportunities exist to develop markets in Asia and elsewhere in the tropics, if manufacturers have the initiative to publicise their products in the right quarters.

Doubtless many manufacturers have sales agents in Asia, but the appointment of an agent is no guarantee that the virtues of a sprayer or duster are brought to the notice of people who are in a position to stimulate demand. To achieve that we believe the manufacturer should get into direct touch with departments of agriculture*, who usually have both research and field branches. How better than by advertising in WORLD CROPS? Research officers are concerned with testing materials and equipment, while field and advisory officers are closely in touch with peasant cultivators. Once apparatus is recommended by research officers, the field staff will endeavour to encourage its use and may even find ways and means of overcoming the difficulties of financing its purchase.

New protein foods

THE SEARCH for new ways to bring protein to diets from which it is now lacking was one of the major topics considered at a recent meeting of an Expert Committee on Nutrition, an advisory body formed by FAO and WHO. (See also WORLD CROPS, 1957, **9**, 352.)

Five foods have been selected for extensive research – fish flour, soya-bean products, groundnut flour, sesame flour and cottonseed flour. The aim is to evaluate the usefulness of such foods as supplements to various types of diets, to establish their safety through experimental feedings to animals, and to study their effects in preventing or curing protein malnutrition, when introduced into local diets. The next step, already reached with fish flour and saridale (soya-bean extract), is to study the possibilities of manufacturing the product at a reasonable consumer cost for local consumption in the area concerned. This research is being financed by funds from a $250,000 grant in 1956 from the Rockefeller Foundation, and by a $100,000 grant from UNICEF.

These proposals must of course be supplementary to the two main lines of attack on the problem of raising nutritional levels – efforts to increase the normal production of food, including milk, and educational measures to encourage better dietary practices, but if some of the new protein foods can be used for human consumption, a substantial contribution will be made to fulfilling the protein needs of under-nourished people.

National dishonour

If a house be divided against itself, that house cannot stand.—St. Mark, III, 25.

IN A policy statement recently issued by Mr. Stanley de Zoysa, Finance Minister in the present Government of Ceylon, an assurance was given that new private foreign enterprises in Ceylon will not be nationalised for the next 10 years and foreign investors will be permitted eventual repatriation of their capital, including appreciation and remittance of dividends. The Government's policy is to welcome private foreign investment in fields which will strengthen the country's economy.

We do not understand how such an assurance can possibly have any value, because it is in the nature of things today that a solemn obligation entered into in all good faith by one government is likely to be repudiated by its successor, if the new government is the opposition or a breakaway party, as represented by the Communistic element in the present coalition government in Ceylon.

It is not our intention unnecessarily to undermine confidence, but, particularly in view of recent events, facts must be faced, for we have reason to know that an award for exceptional services rendered by a technical officer under one Ceylon government was not honoured by its successor. This is a straw in the prevailing wind.

Any government that does not honour the obligations and agreements of a preceding government is indeed weakening the credit of the nation, and if it happens to be a newly self-governing nation it is doing a great disservice not only to itself but to all other newly self-governing nations, who may also be judged by its actions.

Hot water

SOLAR WATER heaters have been developed by the C.S.I.R.O. in Australia and we learn that these are now to be tried out on farms in those areas where fuel or electric power is in short supply. Two pilot units are to be installed by the Department of Agriculture of New South Wales, whose officers will supervise their operation. To allow for any excessively long periods of dull, overcast weather, these heaters are to be fitted with boosters, using either solid fuel or electricity, so as to ensure a constant water temperature of about 200°F and a constant supply of hot water, which is, of course, essential in modern dairy practice.

* One African Department of Agriculture takes 13 copies of WORLD CROPS for circulation and distribution among its officers.

Triumph over difficulties

THE BICENTENARY of the Geigy Co. of Switzerland was recently celebrated in a delightful ceremony which was presided over by Mr. Charles F. Gysin, chairman of Geigy (Holdings) Ltd., of Manchester, who spoke in a broadcast link-up to their associated companies in five continents – Australia, India, South Africa and the U.S.A., and in Europe to the parent company in Basle.

'Science', he said 'knows no boundaries today. The scientist is rendering a greater service to his fellow men than ever before and yet the scientist has never been so misunderstood as he is today. There is misgiving in the layman's mind about science and not all of it springs from fear of the atomic bomb. Even developments of a peaceful nature, like the use of nuclear energy and possibly some advances in medical science, are looked upon with suspicion. The man-in-the-street, not unnaturally, fails to distinguish between the different branches of science and he comes to the general conclusion that scientists have gone too far and that they are juggling with forces which are better left alone'.

We agreed with Mr. Gysin when he said that it is the job of all of us – journalists specially included – to dispel this mistrust of science. 'Science is a good thing' is indeed a message that we all must spread. It is important that people everywhere should be encouraged to support the work of scientists because science today is what we all live by. The new products of chemical industry help to make our homes, our clothes and our gardens look more attractive; they protect our crops, ourselves and our livestock; they provide the raw materials for new industries which are providing limitless new opportunities for employment and should, if properly used, increase the health, wealth and happiness of all mankind.

Mr. Gysin described how the Geigy Co. had sprung from modest beginnings in this tiny country of Switzerland, with its natural handicaps of lack of raw materials, inhospitable mountain and lack of access to the sea, to become a mighty organisation and he provided the reason when he said, 'Our people are very hard-working and strikes are unknown'. Switzerland is; indeed, prosperous and solvent today, and is an object lesson to many other countries to whom Nature has been very much kinder.

Trade with China

FOR ALL practical purposes, there is still no private trading in China. All imports and exports are handled by state trading corporations, which are responsible for negotiating prices, deliveries, terms of payment etc. The senior corporation is the China National Import and Export Corporation (C.N.I.E.C.). This Corporation at one time handled all imports and exports, but it has now delegated its responsibilities for most commodities to a number of specialised trading corporations. Occasionally, enquiries may be received from what might appear to be private firms operating in China but these are invariably joint state or private enterprises and in all cases it can be assumed that they are acting under the control of the appropriate state trading corporation.

Until a few months ago it was not easy for businessmen to visit China, as the Chinese would, in general, issue visas only to persons who had received specific invitations from the trading corporations. Such invitations, we learn, are not usually forthcoming unless the corporations are ready to discuss firm business and also consider that personal contact is necessary for technical or other reasons. Recently, however, the Chinese Chargé d'Affaires has announced that persons anxious to visit China, who do not receive invitations from the trading corporations, may apply for tourist visas*.

Wind erosion

THE PREVENTION of soil erosion is a universal and ever-present problem. In the Netherlands considerable damage is caused by wind erosion, particularly on reclaimed peat soils, the mixed soils of low fen and sand behind the dunes and the sandy soils. Research has been going on in the Netherlands into methods of preventing this soil blowing and a preparation has been tested which gives promising results. The preparation, which comes from starch derivatives, is applied to the soil in a solution of water and can be sprayed with an insecticide sprayer. The chemical binds the top layer of soil and so forms a crust which is strong enough to resist the wind. The trials were carried out on fields planted with asparagus and it was found that the asparagus beds required less maintenance, resulting in a considerable saving of labour, and that the quality of the crop was improved. Heavy rainfall hardly affected the form of the beds and there were no indications of rapid washing out of the preparation.

Coconuts to cordite

FEW PEOPLE are aware of the importance of coconuts as a commercial commodity. They know they are a source of food and drink; a few know that coconut oil is an essential raw material used in the manufacture of various kinds of soaps, soap powders and liquid soaps; and some are aware that it is an ingredient used in the manufacture of margarine and patent cooking oils. Hardly anyone, however, is aware that glycerine is an important by-product of the soap industry, and thus a product of the coconut – the palm with a hundred uses.

Glycerine is an organic chemical, $C_3H_5(OH)_3$, with many unique properties, which can be obtained by 'splitting' any of the animal and vegetable oils and fats, and it is coconut oil which gives the highest yield of glycerine. Glycerine itself has a hundred uses in industry, from printers' inks to its many applications in the manufacture of pharmaceuticals, but its most important utilisation is for the production of blasting and propellant explosives . . . which will forever be associated with the name of Alfred Nobel (1833–96),

* Further information on this subject can be obtained from the Export Licensing Branch, Board of Trade, Gavrelle House, 14 Bunhill Row, London, E.C.1.

the donor of the peace prize which is awarded annually ' to the person who shall have done most or the best work for fraternity among nations, for the abolition or reduction of standing armies and promotion of peace congresses '.

This apparent contradiction is to be explained by the fact that Nobel was a scientist-philosopher-idealist who first of all as a chemist carried out experiments with nitro-glycerine, a powerful explosive of hair-raising instability, which had been discovered in 1856 by the Italian chemist, Ascario Sobrero. His object was to tame this violent explosive for industrial uses and make it safer to handle, transport and explode. Experiments with various absorbants produced ' dynamite '.

In due course these experiments led him to the discovery of ' blasting gelatin ', another industrial explosive which he obtained by combining a mixture of gun-cotton and nitro-glycerine by using a derivative of collodion – a stable form of nitro-cellulose – as a binder. The resulting product was even more powerful than nitro-glycerine, yet it was as safe as dynamite. His experiments inevitably led him into the field of explosives used for human destruction. In 1885 he invented ' ballistite ', a smokeless powder, which he produced by combining nitro-glycerine with gunpowder – a propellant explosive which could be used in weapons of destruction without bursting the weapon. This invention finally led to the production of ' cordite ' in England, a similar product produced by varying the formula and method of manufacture.

' Ballistite ' was his first and last invention of direct military value; it was a disturbing thought to him when dynamite also came to be used as an instrument of war and revolution. Thereafter he directed his researches towards producing a material of such frightful efficacy that war would become quite impossible – which is the idea behind the atom bomb.

Later in his life he began to have his doubts even about this idea and he expressed the view ' that the mere increase in the deadliness of armaments will not bring peace. The difficulty is that the action of explosives is too limited; to overcome this deficiency war must be made as deadly for the civilians in their homes as for the troops in the front lines . . . '. He thought, even then, that the hideous possibilities of bacterial warfare would provide the ultimate supreme deterrent.

But he was still not altogether convinced and he finally came to believe that the only true solution lay in collective security under which all governments would bind themselves to defend collectively any country that was attacked, and it was on the basis of this conception that the Nobel Foundation was established.

This conflict of doubt and idealism is with us still. Can the contrariness and ' bloody-mindedness ' of mankind ever be resolved or is the human race doomed to extinction? We are indeed at the cross-roads.

The language barrier

WE HAVE repeatedly stressed the need for international agreement on the principle of a common world language. With the rapid advances in science and technology and ever-improving communications between nations the need is becoming ever more urgent, but even if the United Nations could prove itself to be sufficiently united to offer a *firm* recommendation it would be 15 years before this could begin to take effect, *i.e.* the time taken to educate a child up to graduate status.

Meanwhile, the immediate task of translating into many different languages scientific literature, published in ever-increasing volume in many different languages, is steadily falling into arrears and, in fact, much valuable information can never be made available. The time lag between the completion of a piece of research and the dissemination of that information is now a matter of years, and there must inevitably be considerable duplication of effort and needless repetition of work already carried out in other countries, such as Russia.

The cause is, of course, the lack of a sufficient number of competent translators, complicated by the many ramifications and the increasing complexity of the sciences. A translator of scientific literature today must not only be a competent linguist, but he must also have specialist knowledge if he is to interpret the subject matter correctly. The position is quite obviously an impossible one, as the number of men and women with such dual qualifications who are prepared to cease active participation in research for the less rewarding, more laborious and less exciting work of translating is very limited.

Various ways of dealing with the problem of the language barrier are considered in a recent UNESCO publication, ' Scientific and Technical Translating and other Aspects of the Language Problem ', but the report lacks a definite recommendation on the one vital issue.

Pre-crop or pre-weed

A reader writes :—

' I want to suggest that WORLD CROPS would render a most valuable service to all if some way could be found of avoiding the confusion caused by using pre-emergence weed control to mean sometimes pre-crop-emergence and sometimes pre-weed-emergence. This irritating ambiguity is found in Australian, English and American writing. If we use pre-emergence to mean spraying the clean ground with a spray harmless to the crop (2,4-D in sugar-cane, sodium p.c.p. in pineapples), then contact spraying would indicate that the weeds were already up and about and we could write pre-crop-emergence where that was intended.'—O. Battine, Queensland, Australia.

OUR INTERPRETATION is that pre-emergence weed control invariably means application before the crop emerges; the idea is to kill the weeds before the crop comes through. Nevertheless, we see no particular reason why one should not substitute the description ' pre-crop-emergence ' for ' pre-emergence ' in order to give perfect clarity, but this is a matter for an official pronouncement.

How a Selective Herbicide Works

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(*A.R.C. Unit of Experimental Agronomy, Oxford University*)

A selective herbicide is a chemical that kills weeds without harming the crops in which they are growing. This article is concerned with the mechanisms by which it is possible for a chemical to be toxic to one group of organisms, the weeds, and harmless to another, the crops

IT is not difficult to find chemicals which will produce different effects on organisms as different as bacteria are from animals, or fungi from crop plants. It is naturally harder to find chemicals which will distinguish between organisms as similar as weeds and crops, where the unwanted and the desired species may belong to the same family or even the same genus – such as wild oats in oats. On the other hand, the user of herbicides has the advantage that his crop and weeds are normally living side by side and not as an intimate mixture of host and pathogen, as is usually the situation in other types of selective toxicity.

The chain of events

In order to understand why some weedkillers are selective in their action it is obviously necessary first to know something of the processes by which the chemicals kill the weeds.

The complexity of the subject can be appreciated if we consider the chain of events that is set in motion every time a toxic chemical is applied to a susceptible plant and realise that selective toxicity may result from differences in the response of crop and weed at any one, or all, of the steps in this process. The most important stages in the plant's response to a herbicide have been set out in Fig. 1. They are concerned with the entry of the chemical into the plant, its passage to the individual cells, where it causes specific upsets in the metabolic processes of the plant, and, finally, the reactions of the plant to these toxic actions. Sometimes this whole sequence of happenings is rapid and dramatic, as when a plant is sprayed with sulphuric acid; sometimes it is slow and tortuous, as when a plant growth regulator, such as MCPA, causes subtle and apparently insignificant changes in the metabolism of the plant, which, as the plant grows, gradually build up into major disturbances that weeks later eventually cause the complete collapse and death of the organism.

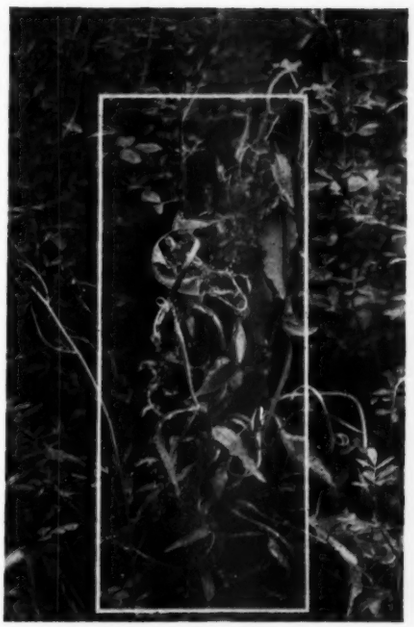
Mechanism of tolerance

The tolerance of a crop to a toxic chemical might be the result of any or all of the following mechanisms:

(i) The chemical failing to reach the ' vulnerable ' cells.
(ii) The chemical failing to affect the ' vulnerable ' cells.
(iii) The ability of the crop to recover from the toxic effects of the chemical.

The selective toxicity of most herbicides could probably be attributed, in part, to all three mechanisms if we knew enough about their modes of action. Unfortunately, our knowledge of the way in which herbicides work is extremely limited and a discussion of their selectivity in consequence must be confined mainly to that part of the selectivity which relates to the arrival of the chemical at the surfaces of the plants, its entry and its movement to the sites of action (mechanism (i)).

In other branches of selective toxicity, chemicals have been discovered which block the utilisation of a substance that is essential for growth in one organism but not in another, *e.g.* sulphonamide drugs. This is a selectivity which is associated with the toxic action of the chemical and is an example of mechanism (ii) above, but, as far as is known, no selective herbicides act in this manner. Differences in the recovery of plants from the effects of herbicides (mechanism (iii)) must also be important. For example, plants capable of sending up new shoots from under-



Curled dock killed in lucerne after treatment with ' Embutox '

ground organs are not controlled by contact herbicides, such as DNOC or sulphuric acid, that kill annual plants not possessing this method of regeneration. The recovery of plants from the effects of slow-acting herbicides of the growth regulator type may also be important, but little is known about this particular aspect of herbicidal selectivity.

Retention by foliage

Leaf surfaces vary markedly in posture, shape, hairiness and wettability and, in consequence, in the amount of water they retain when sprayed. Crops, such as cereals, onions and peas, shed water freely and can be safely sprayed with herbicides that possess no true physiological selectivity. The herbicide dinoseb, for example, is as toxic to the individual cells of the pea crop as it is to those of susceptible weeds; nevertheless, it can be used as a selective herbicide in this crop because the waxy leaves of the pea plant shed the spray and the dose retained by the crop is small in comparison with that retained by the more easily wetted leaves of the weeds. Such differences in the retention of spray

droplets by weeds and crops are an important part of the selective action of most post-emergence herbicides that are in use at the present time. Sometimes it is necessary to accentuate these differences by special application techniques, such as the direction of the spray on to the weeds and away from the foliage of inter-row cultivated crops, or the application of granular formulations of soil-acting herbicides that are not retained by the foliage.

Root entry

Many herbicides can gain access to plants only through their roots. These soil-acting chemicals include the substituted ureas and triazines, IPC (propham), CIPC (chlorpropham), CDEA, trichloracetic acid etc. There is no evidence that plants differ in their ability to absorb such chemicals from the soil and therefore selective toxicity, which is dependent on differences in uptake, seems unlikely. It is sometimes possible, however, to ensure that the greatest concentration of the herbicide is in the soil zone which is being utilised by the feeding roots of the weeds and not of the crop. Relatively insoluble compounds, such as simazin and monuron, which remain in the surface layer of the soil, can, for instance, be employed to control selectively weeds that germinate in the surface layer of soil around deep-rooted perennial crops, even though they possess no inherent selectivity towards the crop.

Entry into shoots

Plants differ considerably in the nature and composition of the cuticle that forms a continuous layer, apart from the stomatal pores, over all above-ground vegetation. Most foliar sprays, whether they are formulated as oils, oil emulsions or in water, enter the plant through the cuticle. It seems reasonable to assume, therefore, that differences in the cuticular make-up of different species do account for variations in the penetration of herbicides. It is difficult to separate differences in penetration from associated differences that may occur as a result of variation in retention on the outside of the leaf, or movement away from the inside of the cuticle. Probably because of these difficulties in separating one factor from another there are few examples in the literature of the specific part played by penetration in the selective action of herbicides. There is, however, no dearth of information to show that leaf anatomy does influence the entry of herbicides. It is known, for instance, that the waxes that form the outer layers of the leaf cuticle of all plants vary in amount and composition from species to species, and that plants with a thick waxy layer are more resistant to penetration by contact weedkillers than are plants with a thin waxy covering. Herbicidal oils and oil formulations penetrate waxy surfaces much more easily than water formulations and it is possible to alter the selectivity of herbicides such as 2,4-D and MCPA by varying the physical and chemical characteristics of their formulations.

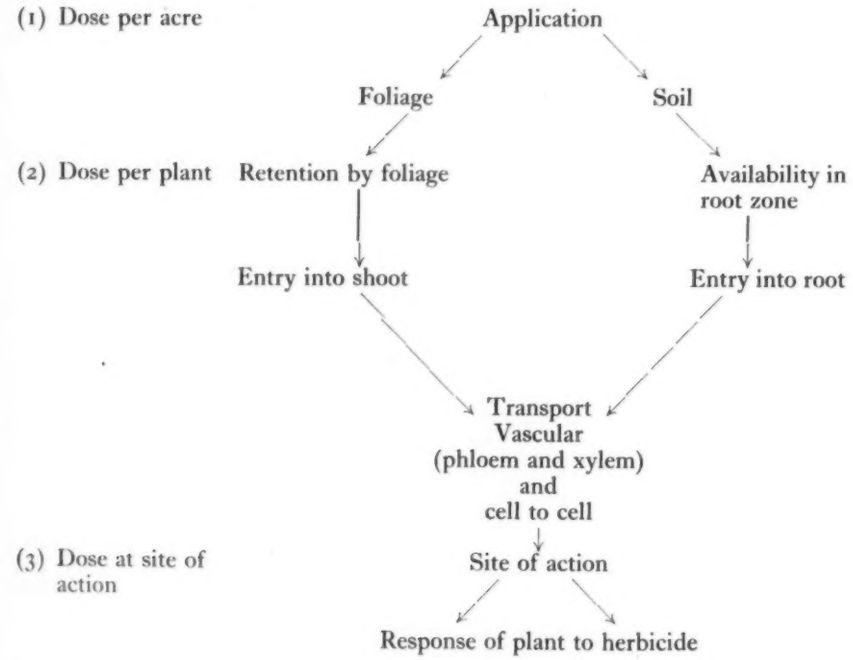
Evidence of the importance of the cuticle in controlling penetration also comes from studies on the effects of the two herbicides TCA and dalapon. Both these chemicals affect the metabolism of plant leaves and, at doses that do not retard general growth, reduce the amount of wax that is formed on the outside of the leaf. By inducing changes in the surfaces of plants in this way it has been possible to alter the relative resistance of different species to penetration by the herbicides DNOC and dinoseb.

Translocation

The path of movement of the herbicide from its site of entry to the cells in which it finally acts may be short, as with contact herbicides, or long, as with herbicides that have to penetrate to the extremities of deep root systems, or rise to the apical shoots of tall trees. The longer the journey and the more time that it takes the greater the possibilities for differences to arise between species. In this connection the relative persistence of chemicals in plant tissues is obviously important.

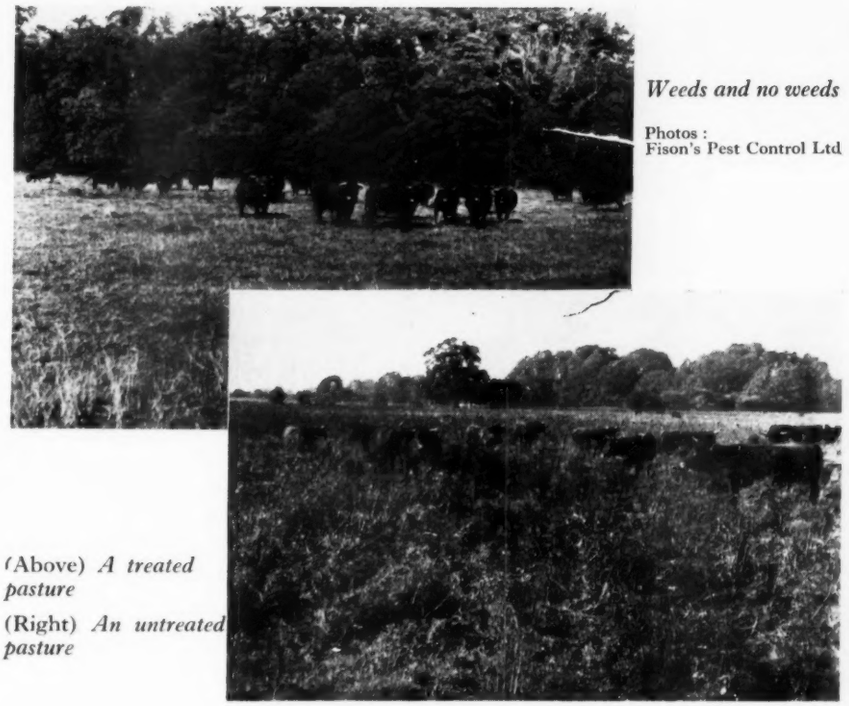
Herbicides are moved within plants by two principal mechanisms: with the transpiration stream in the xylem, or with assimilates in the phloem. The former, which takes place through dead cells, is capable of transporting most water-soluble substances that enter roots and is unlikely to play any important part in the selective action of herbicides. Phloem transport, in contrast, is dependent upon the functions of living cells and on the movement of the products of photosynthesis from leaves. In this system there are differences in the rate at which herbicides are moved by different species. In consequence, it seems probable that variation in phloem transport could account for much of the selectivity of herbicides, such as 2,4-D, MCPA, 2,4,5-T, MCPP and amino triazole, that are capable of movement in the phloem. American workers have, in fact, been able to show by using isotopically-labelled 2,4-D that more

Figure 1
Stages in the toxic action of a herbicide



of the radioactivity moved from the leaves of a susceptible variety of maize than from a resistant variety.

In addition to these two main methods of transport there is at least one other which has not been studied in so much detail, but which may, nevertheless, be very important in connection with the selective action of herbicides. This is the movement that takes place from cell to cell in undifferentiated tissues, such as the mesophyll of the leaf or the cortex of the root. These tissues are vital links in the passage of the herbicide from leaf surfaces into the phloem and from the root hairs into the xylem. It is known that some of the mechanisms involved in this type of transport are metabolic and that they are specific for chemicals and differ with species. It seems probable, therefore, that this cell-to-cell movement, which may be a part of the penetration process itself, and which links entry into the plant with movement within and between the main transporting systems of the xylem and phloem, may well be one of the important keys to the understanding of selective activity in translocated herbicides.



Weeds and no weeds

Photos : Fison's Pest Control Ltd

(Above) *A treated pasture*

(Right) *An untreated pasture*

Differences in enzyme systems

In addition to these general physiological aspects of selectivity which can be partially controlled by means of formulation, as well as method and timing of the application, there is the selectivity which is concerned with specific differences in enzyme systems and which is not capable of manipulation. While it is true that there is little precise knowledge of the enzyme systems involved in the mechanisms of action of most herbicides, recent research has shown how selective toxicity can, in a few instances, be explained by differences in the enzyme systems of tolerant and susceptible plants. This selectivity results from differences in the ability of plants to convert a toxic chemical into a non-toxic one, and the converse, their ability to change a non-toxic chemical into a toxic one. For example, simazin is a very effective chemical for the control of weeds growing in maize. This is because maize plants possess the ability to protect themselves by knocking a chlorine atom off each molecule of simazin that they take up, thus converting a herbicide into a harmless substance. The weeds, on the other hand, do not possess such powers and in consequence are killed.

Toxic conversions

The substituted gamma butyric herbicides (MCPB, 2,4-DB etc.) work in the opposite way: their selectivity is, at least in part, dependent on the ability of the susceptible weeds to convert a harmless chemical into a lethal herbicide. The details of this mechanism have been worked out and it has been shown to depend on the presence in the susceptible plants of specific enzymes which convert the non-toxic butyric molecule into the corresponding toxic acetic acid herbicide, *e.g.* MCPB→MCPA or 2,4-DB →2,4-D.

These are two examples of situations where specific enzyme systems are responsible for clear-cut differences in the responses of different species. It is probable that the selectivity of other herbicides depends, at least in part, on this type of mechanism. Herbicides that are related to the plant auxin (IAA), such as 2,4-D, MCPA and 2,4,5-T, probably act in plant cells at approximately the same places as IAA and initially produce similar responses. They become toxic, however, because, unlike IAA, plants do not possess the ability to inactivate an excess of them. Differences in the response of different species to such herbicides may well be due largely to the differences in their ability to 'neutralise' them. Another example is sodium chlorate, which, like the butyric acid herbicides, is harmless by itself, but is converted by plants into the toxic derivatives, chlorite or hypochlorite. This conversion is carried out by the same enzymes that are responsible for the reduction of nitrate to nitrite, which is a stage in the normal nitrogen metabolism of most plants. It is known that such enzymes vary from one species to another and it is reasonable to assume, therefore, that the slight differences that have been observed in the tolerance of different plants to sodium chlorate might be associated with differences in their complement of nitrate-reducing enzymes.

Other examples of specific differences in enzyme systems that account for herbicidal selectivity will no doubt come to light as our knowledge of the biochemistry of the toxic effects of herbicides increases. It should not be assumed, however, that such mechanisms of selectivity are likely to be as clear cut and definite as might appear from the examples given. Enzymic reactions are reversible, often competitive and always influenced by many factors. It seems probable, therefore, that even in situations where it can be shown that selectivity is largely dependent on a particular difference in the enzyme make-up of crop and weeds there will still be no absoluteness in

the selectivity, and differences in the response of the susceptible and tolerant species will always be influenced by their stage of growth and the manner in which they are growing at the time of treatment.

It might be assumed from the definition of a selective herbicide given at the head of this article that if the correct chemical were used there would be no danger of damaging the crop. This is, unfortunately, not the situation. The selectivity of all herbicides is dependent on their being applied in the correct manner. If too high a dose is used, or if the treatment is made at the wrong time or the wrong formulation is applied, the crop may be severely damaged. It is very important, therefore, that the user of selective herbicides should be fully aware of the properties of the chemicals he is applying and able to vary the treatment procedure in order to obtain the maximum weed control with the minimum of crop damage.

Photo page 277: May & Baker Ltd

Aerial Spraying

A European Agricultural Aviation Centre was founded at a meeting of experts held at Brussels on May 9, 1958, under the auspices of the O.E.E.C.

The Centre, which is to be established at the Hague, will exchange data with the member countries concerning agricultural aviation in Europe and elsewhere, for the benefit of chemical industries, research institutions, aircraft factories and aviation companies, etc. Advice on the development of agricultural aviation will be given on request.

Countries which have already joined the Centre include the U.K., Denmark, France, the Netherlands, Italy, Sweden, Spain and Germany.

Repairing Water Pipes

A Freeze-Seal Unit in operation on lead piping. The closing tool is seen compressing the pipe, and the freezing tool is clipped on the upstream side

The repair and maintenance of pipework generally causes considerable inconvenience because it involves interruption of water supply. It would, therefore, be of considerable value if the pipework affected by the stoppage can be reduced to the absolute minimum.

A device has been produced by which water pipes of various kinds can be repaired. It is simply the freezing of the water in the pipe. The device is a ' Freeze-Seal Unit ', consisting of a portable refrigeration set, with a refrigeration compressor driven through a V-rope drawn either by a two-stroke petrol engine or electric motor.

In operating the unit for lead pipes the pipe is compressed flat by the closing tool (see illustration) being placed close to the burst and arresting the flow of water. Then the controlled drip tool is placed in position on the up-stream side of the closing tool, the centre spindle is screwed down to pierce the pipe to allow a free flow of water under pressure to the drip cork, which is adjusted to allow 20 drips a minute. The freezing tool, fitted with copper bushes suitable for the pipe size, is then placed round the pipe and clipped tightly on the up-stream side of the controlled drip tool.

The machine having been started up previously, the freezing tool will start the freeze immediately it is applied and will form an ice plug within the pipe. The drip tool by allowing an escape of water, ensures that the ice plug is formed with a hollow centre of gradually diminishing bore until the final moment of seal. This free formation prevents any expansion of the ice plug which might cause distortion to the pipe under repair.

When the drip ceases to fall from the drip cock it is an indication that the water in the pipe is frozen, and the supply completely sealed off. The repair may now be commenced.

On completion of the repair the freezing tool is removed and the ice plug will thaw out completely in a few minutes.

Users of this equipment have found that road reinstatement charges and water wastage have been reduced to a minimum because of the speed with which repairs can be effected. A perfect seal, free from drips, is obtained and time and labour are saved. In addition the equipment is useful for locating invisible leaks and it obviates the necessity of cutting the pipe for testing or opening long trenches for examination.

Inquiries about this unit should be addressed to our Reader Service.

The Risks of Pesticides to Fish

E. F. EDSON
(Chesterford Park Research Station)

Pesticidal chemicals may find their way into fish-bearing waters either accidentally from spray, spills and washings; or in empty containers or through air-spraying operations, or deliberately, when they are used for the control of aquatic weeds, vectors of disease, or pests in irrigated crops.

Healthy Fish

THE increasing use of pesticides in weed, insect and disease vector control in waters of tropical countries may often produce an unacceptable fish mortality, with consequent reduction in protein supplies for the population, unless care is taken. The avoidance of risks to fish is especially important in areas where inland fishing or fish cultivation makes a valuable contribution to the country's diet or resources, as in Indonesia, China, Japan and South-East Asia generally.

The harmful effects of such chemicals may be either *direct*, by chemical poisoning of the fish, or *indirect*, as in the production of toxic waters by the decomposition of killed weeds, or harmful effects on food supplies, shade plants, protective vegetation or other environmental features. Although such effects are more likely to be due to the active ingredient in the product used, it is at times possible for injury to be caused or increased by the solvent or manufacturing additives present in the formulation, especially when using undiluted oil-based concentrates.

The probability of many fish being killed in any specific operation with a toxic pesticide is influenced by such factors as the numbers and sensitivity of fish species present, the opportunity for the fish to move readily to unsprayed water, dilution of the chemical in flowing waters, temperature, oxygenation and depth of the water, frequency and method of application, and other variables. Some of these aspects are discussed in more detail later.

From such considerations it is clear that no prophesy of risk or safety to fish could hope to be very accurate, except under very extreme conditions, as when the proposed chemical application rate greatly exceeds the safe limits for fish. It is equally clear that many details have to be thought of when estimating possible risks to fish from a proposed operation. It is often wiser to carry out a small-scale experimental treatment in fish-bearing waters than to attempt full-scale operations without sound evidence on safety to fish.

The main factors

Although the most important single factor may be the innate toxicity of the proposed chemical to fish species, there are other factors which will materially influence risks. For example, it is logical that the use of a chemical in moving waters will usually involve speedy dilution of the contaminant and a reduction of the concentrations to which the fish are exposed. Thus the risks of application to still waters, such as ditches, canals, ponds or lakes, are usually greater than those from application to moving waters, streams, rivers or estuaries. However, in extensive operations on flowing waters, a wide zone of comparatively high concentration may steadily move downstream and may be lengthy enough to cause fish deaths several miles below the point of application. Similarly, where rivers expand into lakes, or where stagnant backwaters occur downstream, pools of chemical contamination may remain for many days or weeks, with little dilution. Thus even direct application to flowing rivers may cause fish deaths some distance from the scene of application days or weeks later.

The deeper the water the less the final concentration after mixing or diffusion is complete. The tenfold

decrease in final concentration due to tenfold increase in depth may not produce fish safety if the initial concentration was excessively high. Furthermore, a chemical may passively or actively incorporate itself with the bottom mud of still deep waters, where bottom-feeding fish may undergo prolonged exposure during feeding.

Most chemicals cause some sensory or repellent effect in fish, which may therefore try to swim to clean waters away from the areas of highest concentration and irritancy. Large-scale treatments, as by air-spraying, massive application equipment or large labour forces may give fish little chance of successfully vacating contaminated areas and thus increase the risks. *Per contra*, small-scale treatments or deliberate intervals between spraying separate ' plots ' on the area may allow fish to escape to safer waters.

Repeated applications to water or the use of concentrated chemical deposits which diffuse slowly will prolong the exposure periods to fish and may eventually produce a serious delayed mortality. Chemicals which are stable in aqueous solution are more likely to cause such effects than those which are unstable in water, *e.g.* TEPP.

The toxic action of most chemicals is increased by raised water temperature, which also increases the solubility of the applied chemical. Thus application to warm waters in tropical areas may cause more fish deaths than similar operations in colder waters. In stagnant waters already partially deficient in oxygen mortality may be greater than in fully-oxygenated waters.

Although concentrate spraying of oil-based pesticides may cause fish deaths due to the oily vehicle, this is less likely to be a significant risk than the deliberate use of aromatic solvents, such as naphtha, fuel oils, etc., to destroy larvae or vegetation. With oily solutions of water-insoluble materials there is a tendency for accumulation of surface oil and chemical to occur at the down-wind margins of the waters, with higher mortality there as a result.

Field evidence strongly suggests that ' miscible oil ' formulations of pesticides (' emulsifiable concentrates ') are much more likely to cause fish deaths than the same chemicals as wettable powders or dusts.

Destruction of fish food supplies, such as aquatic insects and other arthropoda, *e.g.* crustacea and copepods, may often occur at concentrations not themselves injurious to fish, and this is especially likely to occur with insecticidal chemicals. Mortality may then be delayed and due to starvation. More severe effects may occur among eggs and young fish than among adults, so known spawning, breeding and nursery areas may often require specially cautious treatment. When disturbed, fish tend to seek protective cover amongst vegetation; the spraying of densely weedy waters may therefore lead to heavy fish mortality, especially where application is by hand and involves disturbance by boats or wading. It is then especially important to treat the total area in separate small plots wherever possible.

Photos : Angling Times

Dead fish on the bank of the River Trent

Degree of toxicity

The innate toxicity of pesticidal chemicals to fish varies tremendously. Study of the literature, mainly from North America, permits the compilation of a series of tentative figures for maximum safe initial concentrations of the more important pesticides (Table 2). In general, few fish deaths would be expected, if any, if initial concentrations remained below these safe maxima, although the most sensitive species or individuals may die or show toxic effects. The figures suggested in the list are based upon the results of laboratory aquarium studies, but are modified wherever possible to take account of field observations with the chemicals.

In general, the existing herbicidal chemicals (weedkillers) are much safer for fish-bearing waters than the existing insecticides. There is a general correlation, but not a precise one, between toxicity to fish and toxicity to mammals, influenced in some cases by the water stability of the chemical. However, some chemicals, *e.g.* DDT, γ-BHC, toxaphene, copper compounds, have a much higher toxicity to fish than their oral toxicity to mammals would indicate. It therefore cannot be presumed that a new pesticide of low mammalian toxicity is necessarily non-hazardous to fish cultivation.

The use of the figures given in Table 1 may be aided if it is remembered that an application of 1 lb. per acre, when evenly distributed, will cause approximately the following initial concentrations in waters of different depths:

Table 1

Depth of water	*Initial concentration*
1 foot	0.3 p.p.m.
3 feet	0.1 p.p.m.
10 feet	0.03 p.p.m.

Table 2

Approximate maximum safe upper limits for initial concentrations of pesticides applied to fish-bearing waters, in p.p.m.

Insecticides		Herbicides	
Endrin	.0005	Pentachlorphenol	3
Toxaphene	.005	Arsenites	10
Dieldrin	.01	Monuron (CMU)	20
Aldrin	.01	DNC, DNBP (dinoseb)	10–100
DDT	.05	Maleic hydrazide	50
γ BHC	.05	Hormone-type weed-killers 2,4-D, MCPA, 2,4,5-T,	50–100
Heptachlor	.05	Dalapon	1,000
Chlordane	.05	Chlorate	2,000
Parathion	.1	Borate	2,000
TEPP	.1		
Rotenone	.1		
Malathion	.1		

Fungicides			
Mercury compounds	.001	Soluble copper compounds	3

Conclusions

It is thus evident that significant risks to fish in irrigation, fish cultivation or natural waters may arise from the direct application of the insecticides endrin, toxaphene, DDT, γ-BHC, dieldrin, aldrin and heptachlor. Among the other compounds, somewhat similar or smaller risks may arise from the deliberate use of the herbicides pentachlorphenol and arsenites, and the fungicidal mercurial compounds. As a general rule, therefore, the 10 materials mentioned above should not be directly applied to natural or irrigated waters in which fish are an important 'crop'. Irrigated crops should preferably be treated only after draining the fields or at least after lowering the water level to an adequate minimum. Water from treated fields should be held back from flowing into adjacent pure waters for at least one week and preferably for two weeks. Otherwise most of the modern pesticides have only limited toxicity to fish and by their application rates and normal methods of use are unlikely to cause any adverse effects, even when deliberately used in fish-bearing waters. Knowledge of the factors, here described as increasing risks to fish, if applied to the operation, would go far towards making even the more dangerous insecticides and herbicides free from disastrous effects on fish populations.

Ninety Degrees Below Zero

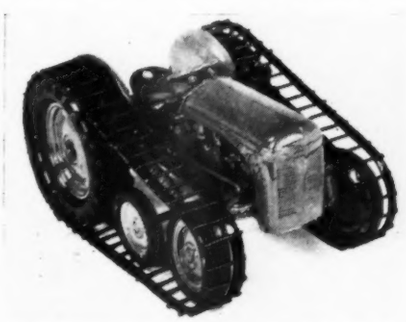
An interesting sidelight on the wonderful achievements of the Commonwealth Transantarctic Expedition is that ordinary farm tractors have been put to the test under conditions of extreme cold and very rough treatment and have not been found wanting.

As a result of 12 months' work with the Australian Antarctic Expedition of 1954, it was decided to use Ferguson equipment to assist in the erection of bases on both sides of the Antarctic continent. In each case the range of implements for use with the tractor included high-lift loaders, winches, transport boxes and small bulldozer blades. In all, seven tractors were shipped by two expeditions in the autumn of 1955: two diesel-engined models and four using petrol.

In his report, the Chief Engineer to the Expedition wrote: 'The Ferguson has worked for 565 hours since landing here one year ago. It has been outside without any weather protection. It has given no trouble at all and no parts have been required.

'The terrain and working conditions are tougher than anyone would expect a machine to continue to operate upon with such complete reliability. It has been operated by a number of people and hasn't been given gentle treatment at all. The rocky terrain provided the roughest surface that could be found – many loose scree slopes and areas of loose boulders.

'It has had a hand with almost every job on the station – including haulage of stores, stacking, levelling hut sites, carting rock fill, lifting hut sections, hauling seals for dog feed, providing light to enable after-dark working when emergency outside jobs had to be performed. Without the winch many jobs might not have been possible.'



The Ferguson tractor as used in the Antarctic

Manufactured for Massey-Ferguson by the Standard Motor Company, these tractors were taken from the normal production line. The chief modifications made to suit the tractors for Antarctic conditions were the provision of silicone rubber insulation for the electrical system, and of full-tyre tracks to wrap around the front and rear wheels. Apart from these modifications, together with larger batteries and a larger starter motor, the tractors were in almost every other respect the same as those used on farms all over the world. In other words, this tractor can work as efficiently at 90° below zero as at 90° above.

Technical News

Articles in the July issue of some of the other journals of the Leonard Hill Technical Group include the following:

Manufacturing Chemist. – 'Safety in the Chemical Industry' by Sir W. H. Garrett; 'Wetting Agents for Agricultural Sprays' by J. S. Stanley.

Petroleum. – 'Petroleum Prospecting by Microbiology' by A. Luchter; 'Oil and Natural Gas in Italy' by T. H. Skeet.

Chemical & Process Engineering. – 'Heat Transfer'; 'Review of ACHEMA Exhibition'.

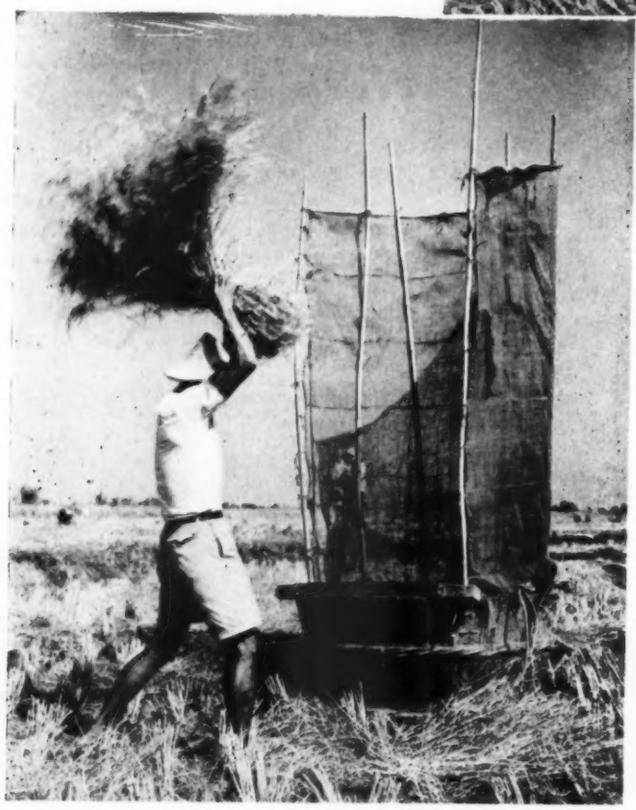
Automation Progress. – 'Automatic Programming and Magnetic Amplifiers in Rolling Mills' by A. Asbury and H. Law; 'Continuous Heat Treatment with Automatic Control' by R. O'Donoghue and L. Palethorpe.

Dairy Engineering – 'Glass for Pipelines' by R. Scott; 'Automatic Cleaning for 5,000 ft. of Pipelines'.

Formosan Rice

V. BENNETT

The Chinese farmers of Taiwan (Formosa) expect a record rice harvest this year. Their 1957 harvest of 1.9 million metric tons of rice, as recorded in January this year, eclipsed the 1956 harvest of 1.8 million tons.



From miles around, farmers come to help each other harvest the vital rice crop. The cylindrical screened buckets are for separating the hand-threshed grain

Left: *The grains of rice are beaten free of the stalks by hand. Elsewhere new threshing machines, operated by pedals, are in operation*

WITH 10 million people living in the island, Taiwan, an island off the coast of China, is one of the most densely populated countries in the world. In order to remain self-supporting in rice and other farm products, she needs to extract the last ounce of potential from all her farmlands. The Chinese farmer and his family must work from dawn to dusk and seven days a week.

Despite the enormous population pressure in this 13,000 sq. mile island, 770,000 farm families cultivate something like 317,000 acres of riceland. So intensive is farm cultivation in Taiwan that three out of every seven people in the average farm family work in the fields. As a result food is so plentiful that the people of Taiwan say proudly, 'There is not a single beggar on our island'. The 1957 crop even allowed the export of some 200,000 tons of rice, mostly to Japan.

Much of the success for the mounting rice harvests can be credited to the island-wide advisory service of the Chinese-American Joint Commission on Rural Reconstruction. Their experts have helped to breed new varieties of rice, improve farm methods in general, taught the use of fertilisers, developed and improved seed multiplication and advised on insect and pest control, post-harvest storage techniques and the use of new machines and new implements.

George Yeh, Free China's Minister of Foreign Affairs, calls Taiwan's soil 'The worst foundation for an agrarian economy in the world'. It is nitrogen deficient and requires the heavy use of fertilisers.

The island's best rice is a variety called *Ponlai* or 'Angel's Rice' and is considered the finest in the world. *Ponlai* comprises about 40% of the rice grown; the remainder is mostly the ordinary indigenous rice. Taiwan's rice production methods are symbolic of the new Orient; customs im-

Rice – staple grain of the orient

memorial are being blended with modern practice in seeding, planting, production and marketing.

Thousands of youngsters now learn rice culture in instruction extending beyond their normal schooling and they are encouraged to experiment on their own. Travelling film units visit their villages after dusk to give special shows on agricultural topics.

Rice harvesting is a colourful family affair. It takes place from May to July for the first crop, and from October to the end of December for the second. Farm families make it a community event and each helps the others cut their rice, thresh it with foot-paddle threshers or by hand, and bag it. As soon as one crop is ready for harvesting the farmer is already making preparations for the second.

Often he cultivates other crops between harvests, such as sweet potatoes, tobacco, wheat and corn. Every foot of land is used – even dry river beds become green and lush with vegetables. Other crops grown in Taiwan are broad bean, radish, rape and soya bean.

Because rain so often interferes with the drying process newly introduced American rice driers are proving their worth. The farmer can now store his rice in his home until it is convenient for him to send it to the farmers' association warehouses.

Rice distribution is either effected through the usual channels – shipper, miller, wholesaler, retailer – or through some 340 Government-sponsored farmers' associations. The marketing standards for rice are rigidly supervised and speculation in rice or manoeuvring within the market is considered much like speculating with life itself, because no other food is so vital to the life of the country. No rice merchant may hide, hoard or otherwise refuse to sell his stock, and a shipper must ship the rice within 10 days after receipt of stock. The business relations of rice merchants are also carefully examined. Books must always be up to date and ready for audit at any time.

Logically enough, any violators of the rice laws are subject to penalties, the severity of which is in direct proportion to the quantities of rice involved.

My object all sublime
I shall achieve in time
To make the punishment fit the crime.
' The Mikado ',
Gilbert and Sullivan.

For the Chinese rice farmer the year is one continuous vigil. Water levels must be kept constant in the paddies, often by pumping. He must fight a particular fungus that causes blast, a withering rice disease. He must be on guard against insect pests. The faulty use of fertilizers would damage the crop. From the germination of seedlings to harvesting the grain he cannot afford a moment's laxity.

Photos : Hamilton Wright

The rice must be dried in the sun to reduce moisture content, thus making it suitable for long storage and export overseas

Application of 2,4-D from a spray boat typical of those used in the Government's programme of eradication

Eradication and Control of Water Hyacinth

Results of a campaign in the Belgian Congo in 1955—57

H. KIRKPATRICK

(*Boyce Thompson Institute for Plant Research, U.S.A., and Consultant to the Government of the Belgian Congo*)

To deal with the serious problem of the aquatic weed which was completely blocking many of the smaller tributaries of the Congo river, the Government of the Belgian Congo initiated a scheme for its total eradication. This article is an account of the operations and gives some valuable conclusions.

THE water hyacinth, *Eichornia crassipes Solms.*, was reported by DuBois as present in the Belgian Congo in 1954.[1] At the request of the Belgian Congo Government a survey of the hyacinth situation was made in November 1955. The results of the survey indicated that 1,000 miles of the Congo River between Leopoldville and Stanleyville were infested with water hyacinth. Recommendations were made for its eradication, based on the results obtained in 1948 and 1949 in a joint operation organised by the Boyce Thompson Institute for Plant Research Inc., Tulane University, and the U.S. Corps of Engineers, New Orleans District. This project had resulted in the successful killing and sinking of water hyacinth by the application from boat or helicopter of 8 lb. of 2,4-D per acre of plants.[2,3]

The problem

At the time of the survey in 1955 a thousand miles of the Congo River between Stanleyville and Leopoldville were infested with water hyacinth. The infestation was evident as small scattered fringe growths and as small scattered groups of plants floating on the surface of the main channels of the river. The infestation in this area alone involved approximately 25,000 miles of shore line because of the many hundreds of islands in the river. In addition, the Ubangi River showed a relatively high degree of infestation between its confluence with the Congo River and a point about 400 miles upstream. There were also scattered reports of small infestations in some of the main tributaries of the Congo River, but none of these reports was confirmed.

The treatment

It was recognised in 1955 that the Congo River proper was in no danger of becoming blocked to navigation by hyacinth, as a current of 3 to 4 m.p.h. and over, limits the size of the fringe growths. However, the existence of this fringe constituted a threat of possible infestation and blockage to many of the smaller tributaries and channels within the entire watershed. Thus the recommendations on which the Government's programme of eradication was based emphasised that the initial phases of the programme must be completed in the shortest possible time, otherwise the infestation would become so widespread as to make eradication virtually impossible.

The operations involved the use of an amine salt formulation of 2,4-D, applied by boat-mounted equipment at the rate of 8 lb. of the free acid equivalent per acre of plants. To achieve this a 1% solution of 2,4-D was applied at the rate of 100 gal. per acre. This concentration was later reduced to 0.7% and proved fully effective. An amine salt rather than an ester formulation was used to eliminate volatility and vapour damage to sensitive crops growing near the areas under treatment.

The plan

The original plan, approved by the Government, consisted of three phases: (1) initial application; (2) follow-up spray; (3) patrol maintenance. Because of the great distances involved, the follow-up spray was applied within two weeks of the initial application. This resulted in the killing and destruction of more than 99% of all hyacinth in the treated area. The few remaining plants were eradicated in the patrol maintenance phase, which was carried out within two months of the initial application.

The operations

The boats used in applying the initial sprays were powered by marine engines, were of shallow draft, and were large enough to carry personnel, equipment and material needed for one day's work. The spray pumps used were petrol-driven and had a 20 gal. per min. capacity. They were fitted with hand-operated spray guns and with tips that applied a solid cone-type spray pattern up to 50 ft. Native labour, under the supervision of a European, was used in applying the sprays. Smaller pumps of 4 gal. per min. capacity were employed for the patrol maintenance work and small hand - propelled boats were used wherever possible. As the programme progressed it was found that the smaller capacity pumps were more economical to use in the initial phase of the programme than the larger pumps and were just as effective. At the time of the survey in 1957 spray tips having a 3.5 gal. per min. output were being used in preference to the larger capacity tips in all phases of the operation.

The original plan called for a large number of spray boats, since the progress of the operation naturally depended upon the number of boats used; enough boats and personnel were therefore provided to ensure that the operation could be completed within one year. The programme did not get under way until April 1956 because of the time needed to solve the many problems involved in the organisation of the programme in relation to the acquisition of boats, equipment, material and personnel. Progress was slower than was anticipated because of the many difficulties encountered in the supply and maintenance of equipment and owing to lack of sufficient personnel and an increase in the areas of infestation. During the time required to initiate the programme, hyacinths infested some of the most important tributaries and many of the channels within the numerous islands in the river. The diversion of equipment to these areas slowed down the progress.

The results

In spite of these many difficulties, the Government, in a period of 18 months, practically eradicated hyacinth in all but one of the tributaries (Mongala) and in 400 miles of the Congo River between Stanleyville and Esumba Island (Table 1). The only remaining infested areas noted in the survey in 1957 were in the Congo River below Esumba Island and in the Ubangi River between the Congo and a point 10 to 15 miles up river. The regions cleaned and maintained free of hyacinths in 18 months of operation involve a fringe area of approximately 10,000 miles. The bending and killing responses induced by the 2,4-D appeared even more rapid in the Congo than in the Gulf coastal areas of the United States. Complete bending and leaf browning occurred within 22 hours and the plants macerated at the crown within three weeks. Six or seven weeks after treatment the plants had sunk. The quick response made the follow-up spray very effective, since the missed plants could easily be spotted. All plants sprayed were killed and no regrowth was noted except on plants receiving an ineffective dosage, beyond the reach of the spray pattern.

Discussion

The successful eradication of water hyacinth in extensive areas of the Congo, under the most adverse operating conditions, confirmed the results of the co-operative project completed in Louisiana in 1949, but the reported cost of the eradication programme was excessive. By the more efficient use of personnel and the use of simpler types of spray boats and equipment the cost could be reduced considerably. At present the money spent for 2,4-D represents only about a quarter of the total cost of the operation. Irrespective of the cost, the significant fact is that 2,4-D was effective and that it can probably be used at a still lower rate than that used by other workers elsewhere.

In the course of the survey in 1957 evidence was gathered which indicated that many of the waters in the tributaries and channels emptying into the

Water hyacinth clumps floating downstream on the surface of the Congo River

Table 1

Status of important rivers in the Belgian Congo within the area of water hyacinth infestation before and after the 2,4-D Programme of Eradication

River	*Condition April* 1956	*Condition Sept.* 1957
Congo	Infested – 1,000 miles	Infested – 600 miles
Lindi	Clear	Clear
Lamami	Infested	Clear
Aruwimi	Clear	Clear
Itimbiri	Infested	Clear
Mongala	Infested	Infested
Lulonga	Infested	Clear
Ikelemba	Clear	Clear
Ruki	Clear	Clear
Giri	Infested	Clear
Ubangi	Infested	Clear*
Kasai	Infested	Clear
Fimi	Clear	Clear
Lukenie	Clear	Clear
Kwilu	Infested	Clear
Kwango	Clear	Clear

* Except for 10 to 15 miles at mouth

Congo River were toxic and would not support the growth of water hyacinth. This fact was not recognised until 1957 and it emphasises the need for obtaining information based on reliable data on the growth behaviour of plants involved in an eradication programme. The large areas in which this toxicity occurs decrease considerably the areas of possible infestation and thus simplify to a large extent the problems of eradication or control.

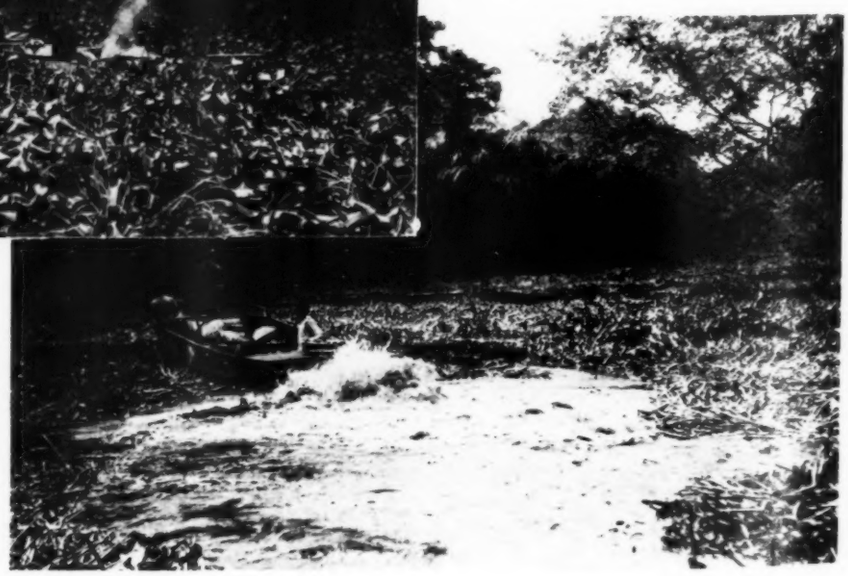
It is of the utmost importance that careful notes and records should always be kept during the operations to obtain significant data so that the programme can be modified to obtain increased efficiency and to reduce costs. Every region has its own peculiar troubles, which must be considered in formulating any programme of eradication in other parts of the world.

Conclusions

2,4-dichlorophenoxyacetic acid has been used successfully in the Belgian Congo to eradicate water hyacinths. The successful use of 2,4-D resulted from the application of not less than 0.7% solution of an amine salt formulation at the approximate rate of 100 gal. per acre of plants. This is equivalent to an 8-lb. application of the free acid equivalent of 2,4-D per acre.

Boat-mounted equipment proved satisfactory in applying the sprays under the conditions found in the Congo at the time of the operations. Helicopter applications should be as effective in situations more suitable for their use. Reinfestation by seed appears remote; however, the programme of patrol maintenance is designed to clean up any such re-infestations before they become widespread.

A programme of control, rather than total eradication, sometimes appears to be warranted because of the initial cost of an eradication programme. It appears, however, that 2,4-D could be used to eradicate water hyacinth anywhere in the world wherever the economic losses due to the presence of the weed would justify the expenditure.



Blocked channel showing hyacinth growth at time of treatment

Below: *Plants dying and sinking three weeks after treatment*

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Photos: By courtesy of Congopresse, Belgian Congo.

Scrub Control By Chemical Means

(Specially contributed by May & Baker Ltd.)

The effective control of secondary jungle, brushwood, bush and scrub will not only release more land for agriculture, but will also reduce the incidence of such diseases as malaria and sleeping sickness.

ARBORICIDES, if not entirely neglected, have received comparatively little attention until fairly recently. Now the need for land economy and increased food production, labour shortages and the enhanced significance of old problems, such as rabbit control, have given them a new importance.

The chemical control of woody weeds or scrub – to use a more convenient term – is less complicated than control of herbaceous weeds, in that arboricides usually need be selective only in so far as they must spare grasses. On the other hand, few of the various weedkillers used against herbaceous weeds were of practical use against scrub, since they were either not sufficiently toxic to plants with woody stems or presented difficulties of application, both limitations making them uneconomical.

The development of the growth-regulating chemicals 2,4-D and 2,4,5-T has overcome these difficulties. Concentrated spray materials based on the low-volatility esters of both these substances have been found to kill not only the herbaceous weeds normally controlled by 2,4-D, but also many of the woody weeds that together make up brushwood – or scrub. Since they are oil-based, they are not easily washed away by rain and their penetrative properties are enhanced.

Need for scrub control

From the point of view of land economy in general, scrub control is necessary to claim or reclaim ground for cultivation and to prevent encroachment of scrub upon ground already in use. Farmers in the British Isles have, at the moment, another reason for the same exercise; a particularly pertinent one – rabbits!

A typical scrub problem, bramble encroaching on to grazing land

Bracken, gorse and other areas of scrub were always favourite sites for burrows. Now rabbits which have survived the myxomatosis epidemic are not necessarily burrowing at all, but are breeding on the surface in the shelter of brushwood which was once merely a cover for their underground activities. So much clearance is involved in the rabbit war that to achieve it by mechanical means alone would be a Herculean task. With brushwood killers the task becomes more manageable. Also scrub growth can cause damage to fences, can choke ditches and drains – especially those which are dry in summer – and can present a considerable fire hazard.

Farmers are not the only people to whom large-scale scrub control presents a problem. Road and rail authorities have always had to contend with encroachment, to keep permanent ways and embankments clear by mechanical methods being especially difficult. Scrub which is allowed to grow near railway tracks presents a considerable fire hazard.

In many overseas areas, apart from these problems, control of scrub is a necessary part of the war against insect-borne diseases. Trypanosome infection, causing the African sleeping sickness in man, and a similar disease in cattle resulting in emaciation and death is produced by the bites of the tsetse fly. One aid to eradication is the destruction of the low jungle and bush that harbours these insects. Huge areas are involved and – even if local labour happens to be readily and cheaply available – manual or even mechanical clearance is often impossible. In Rhodesia, where the Kariba dam project gives them particular significance, experiments are being made to discover if large-scale chemical treatment can solve the problem. Until the results of trials in various parts of the world have been published it will not be possible fully to list the species of woody weeds which are susceptible to 2,4-D and 2,4,5-T.

Table I, however, gives a good indication by showing the variety of brush in the British Isles which can be controlled. The applications refer to a 2 : 1 mixture of 2,4-D and 2,4,5-T butoxyethyl esters of total acid equivalent 70% (7 lb. per gal.).

Methods of application

There are three general methods of application, the spraying times given all relating to the United Kingdom:

Foliage spray. This is the most effective method for small scrub, particularly brambles and briars. It should be carried out when the plants are in full leaf and growing vigorously. Brambles are much more susceptible

Table 1
Methods of application

Plants controlled	*Foliage spray (in 100 gal. water per acre)*	*Basal bark spray (in 10 gals. of oil)*	
		Individual treatment	*Jet spray for young growth*
Bramble	2 pints	—	—
Briar			
Herbaceous weeds			
Elder	2 pints	1 pint	2 pints
Broom			
Birch	2 pints*	1 pint	2 pints
Poplar			
Willow			
Saplings			
Alder	3 pints	1 pint	2 pints
Blackthorn ..			
Chestnut ..			
Elm			
Gorse			
Hazel			
Hawthorn seedling			
Hornbeam ..			
Oak seedling ..			

* For older trees, 3 pints

at this stage than when newly shooting. Thorn hedges can be cleared of brambles without much risk, so long as the spray is directed as much as possible on to the bramble foliage. This can be done with a hand lance attached to an ordinary ground crop sprayer. It is essential that the foliage should be completely drenched, about 100 gal. of water per acre being needed to achieve this. Treatments given between mid-May and mid-July produce the most lasting results. There may be considerable regrowth in the following year if treatment is applied later than mid-July.

Basal bark spray. For the control of saplings up to 1½ in. in diameter and dense birchwood brush, where effective foliage spray is difficult, the requisite amount of the arboricide (see Table 1) is mixed with oil (kerosene, vaporising, gas or diesel oil) and applied to cover the lower 3 ft. of the bark. Treatment can be applied individually or dense young scrub can be given a drenching spray. A single jet aids penetration of very dense growth. Absorption is assisted by frilling or slashing the larger growths before treatment. This may be applied at any time of the year, but the most effective time for treatment is between early February and mid-July.

Stump treatment. Where hand cutting has been carried out, the stumps remaining can be killed with a 1 in 40 mixture of arboricide and oil, painted or sprayed on to the cut surface within a few days. This method is particularly effective with hardwood species of diameter greater than 1½ in., and for the control of gorse. Treatment within a few days of cutting is the most effective and economical method. Treatments applied later than this must be very thorough. Winter treatment, using oil as the vehicle for the chemical killer, has given encouraging results with certain species – hawthorn, for example – which are normally resistant to summer treatment with water. This combination of mechanical and chemical treatment has been proved valuable in clearing large areas of gorse and preventing reinfestation.

The Department of Agriculture, Auckland, has recommended the destruction of as much gorse as possible by normal farm management methods, followed by a finishing application of brushwood killer. The same authority recommends chemical treatment for rushes. The spray is much more effective on soft, sappy regrowth than on tall, mature growth. It is recommended, therefore, that the rushes are cut so that the regrowth can be sprayed about January. The Department points out that, while spraying will kill most species of rush, it is important that the area be drained as well as possible and that the pasture be made vigorous by top dressing.

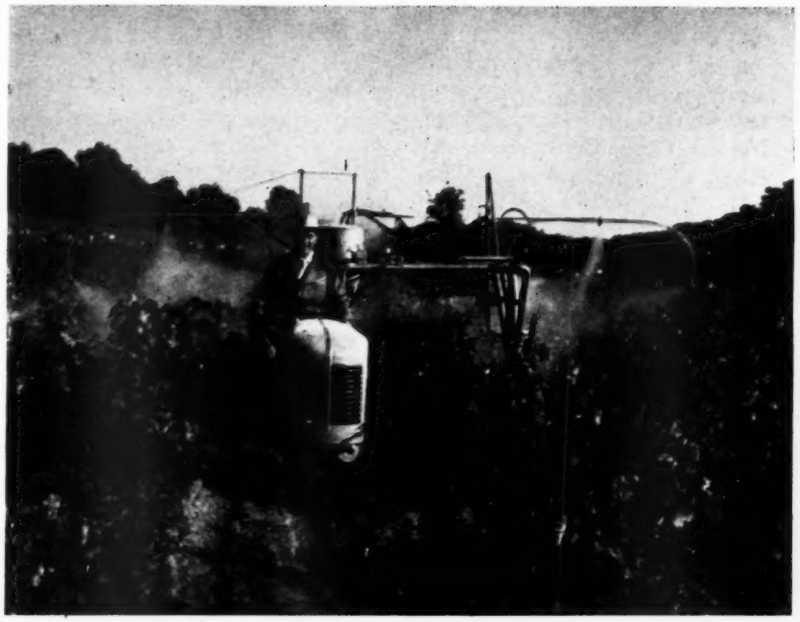
One of the characteristics of the 2,4-D and 2,4,5-T formulations is that grasses are unharmed by them and form a natural and manageable cover once the brushwood has been removed. All normal precautions should be taken, however, against the dangers of spray drift, particularly in windy weather. The height of the boom in brushwood spraying is usually such as to call for special care.

Control of bramble: five weeks after spraying with 'Spontex'; the untreated area is on the right

In Defence of Bordeaux Mixture

A. V. COOMBS, DIP.AGR. (WYE), A.I.C.T.A.

(*British Sulphate of Copper Association Ltd.*)



Spraying vines in France with Bordeaux mixture

The views of most plant pathologists on Bordeaux mixture could probably be expressed in five words and a dash: 'the best protective fungicide but –'.

Of the effectiveness of Bordeaux mixture there has never been any doubt and ever since its fortuitous discovery by Millardet in 1885 it has remained the choice of growers in all parts of the globe, for crops ranging from potatoes in Ireland to bananas in Jamaica; from cocoa in West Africa to vines in Europe and from coffee in Brazil to tea in Indonesia. No exact statistics are available, but it is estimated that out of a current annual world production of some 350,000 tons of copper sulphate at least 250,000 tons are utilised in the preparation of Burgundy or Bordeaux mixtures, which means that several million acres of crops are today being sprayed with these mixtures.

What, in this modern age of high-pressure salesmanship for proprietary fungicides and the craze for something new, makes this simple, home-made fungicide remain so consistently popular with growers all over the world? The answer is probably to be found in the writings of workers such as M. H. Moore, of the East Malling Research Station, who in 1954 wrote: 'Post-war research and experimental work has been focused on the search for new materials as never before, but it is doubtful whether a better protective fungicide than home-made Bordeaux mixture has yet come to light'; or B. T. Narayanan,[2] who, writing in the annual report of the Research Department of the Indian Coffee Board for 1954–55, said: 'Repeated trials with proprietary, organic or systemic fungicides still continue to show that spraying with Bordeaux . . . is the most effective method of controlling leaf disease (*Hemeleia vastatrix*); or, again, J. Grainger,[3] of the West of Scotland Agricultural College, who in October 1957 wrote: 'It (Bordeaux mixture) and its congener, Burgundy mixture, in which washing soda is used instead of lime, still give greater control of blight than any of the other substances tried over the last four years at Auchincruive'.

What of the 'but –'? This invariably relates to the fact that Bordeaux mixture, in common with other copper fungicides, has been found to be slightly more damaging to the foliage of some plants than organic fungicides; and also generally to the so-called trouble involved in preparing Bordeaux mixture on the farm.

Academically, Bordeaux mixture does appear to possess these faults. The perfect fungicide has not yet been found and probably never will. Until it has, let us try and keep its defects in their true perspective and look at them through the eyes of the economist rather than those of the scientist.

Concerning the phyto-toxicity of Bordeaux mixture, the economist's answer will surely be that when dealing with plant diseases the grower is not concerned – unlike those dealing with the control of human and animal diseases – if occasionally some of the foliage scorches slightly, provided the disease is controlled and the crop yields the most economic return, which, after all, is the ultimate goal of farm or plantation management.

Now let us examine the complaint so often heard, although never from the regular users, that Bordeaux mixture is too troublesome to prepare. Why do plant pathologists and experimenters, after eulogising the effectiveness of Bordeaux mixture, generally qualify this by stating that it is tedious to prepare? It is possible that, unlike the regular commercial grower, the research worker generally has not the necessary simple equipment handy, *e.g.* a wooden tub or a measure to facilitate weighing out the correct quantities of the two ingredients, and thus unconsciously tends to exaggerate unduly the difficulties entailed in preparing the mixture.

Not very long ago a works study lecturer for the British Productivity Council, in dealing with the vexed problem of household chores, exploded the popular fallacy that a housewife's work is never done. Similar startling revelations will assuredly come to light if the grower will take the trouble of applying a simple work study test to find out for himself exactly how much labour is, in fact, involved in the preparation of Bordeaux mixture in the field. Provided the preparation is efficiently planned and the modern

' instant ' method of mixing is adopted, it will be found that for all practical purposes Bordeaux mixture is as labour-saving to prepare as any of the proprietary copper fungicides which are claimed merely to require sprinkling on the surface of the water and stirring.

The ' instant ' method of preparing Bordeaux mixture in the field consists of placing the desired amount of the finely granulated snow copper sulphate on the strainer of the spray tank and washing it through with water. When the tank is half to two-thirds full, the necessary quantity of hydrated lime (or washing soda if Burgundy mixture is being made) is placed on the strainer and similarly washed through with the agitator working.

In the preparation of Bordeaux mixture there has in the past been a certain amount of controversy as to whether the lime should be added to the copper sulphate solution, or vice versa. Some workers have favoured the first and others the reverse process. The end-product of the reaction will, it is generally conceded, be the same whatever the method of mixing. Unsatisfactory precipitation is likely to occur only when stock solutions are mixed together without previous dilution of at least one of them.

Bordeaux mixture is such an old fungicide that for many years past it has rather been taken for granted that all agriculturists are familiar with it and its principal component, copper sulphate. It will not, therefore, be amiss to conclude with a few relevant details.

Copper sulphate ($CuSO_4\ 5H_2O$), which contains approximately 25% Cu, is invariably sold with a guaranteed purity of 98–100% and is produced in a number of grades, varying from large lumps of 1 in. or more in diameter, from which it appropriately gets its name of bluestone, to very fine powders of almost the fineness of talcum powder. The three commonest grades, however, are crystals (generally above $\frac{5}{16}$ in. in diameter); small crystals (passing through a $\frac{5}{16}$-in. riddle) and snow (granulated). The last named, which, except for its blue colour, not only resembles granulated sugar, but also dissolves as readily as sugar when placed in water, is the grade generally favoured for the preparation of 'instant' Burgundy or Bordeaux mixture.

Bordeaux mixture. This is prepared in various strengths from copper sulphate, hydrated lime and water. The conventional method of describing its composition is to give the weight of copper sulphate, the weight of hydrated lime and the volume of water in that order. The percentage of the weight of copper sulphate to the weight of the water employed determines the concentration of the Bordeaux mixture. Thus a 1% Bordeaux mixture would have the formula 10:12½:100, the 10 representing 10 lb. copper sulphate, the 12½ representing 12½ lb. hydrated lime and the 100 representing 100 gal. (1,000 lb.) water. As copper sulphate contains approximately 25% Cu as metallic copper, the copper content of a 1% Bordeaux mixture would therefore be 0.25%.

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Tree Planting in New Zealand

Tree planting in Central Otago is complicated by the generally low rainfall and the frequency of frosts, often of considerable intensity, which markedly reduce the number of species which have any chance of survival. Heavy frosts not only inhibit the growth of certain plants, but may affect all kinds by raising them above the position in which they were planted—a process known as ' frost lift '.

Frost lift can be countered by the use of a mulch, but care must be taken to choose one which will not blow away readily nor pack down so tightly that it becomes impervious to water.

Where watering is possible, the range of possible trees is greatly extended and can include such desirable species as Douglas fir, larch (on hilly country), *Sequoia gigantea* (Wellingtonia), oaks and ash.

Another aid to growing a greater variety of trees is the raising of shade-tolerant species under an open-grown nurse crop. The nurse crop could be *Eucalyptus gunni* or *Robinia* or even perhaps tree lucerne (*Cytisus proliferus*); it should be allowed to grow several feet in height before the permanent crop is introduced. Trees that could be grown with such initial protection include the silver firs, hemlocks, and even western red cedar.

Time of planting

Planting should be done at the beginning of the rainy season, whether that occurs in late autumn, in winter, or in early spring. Plants put in then will have a better chance of becoming established before drier conditions set in.

Dry conditions necessitate wider planting than is carried out in wetter climates, because roots have to spread farther in search of moisture. It is unwise to plant closer than 8 ft. × 8 ft. (680 trees per acre), and 10-ft. or 11-ft. spacings will probably produce better results.

Recommended species

For places without regular water supply the following tree species are recommended:

Betula alba (European birch) is suitable for firewood and beautification.

Cupressus arizonica (Arizona cypress) is an ideal shelter tree.

Eucalyptus gunni (cider gum) gives fair shelter, at least when young, and older trees will make fair posts.

Pinus laricio (Corsican pine) is slow growing, but yields a high-density timber which, however, is not durable untreated.

Pinus murrayana (lodgepole pine) is faster growing than Corsican pine. The timber is not durable untreated.

Pinus ponderosa is faster growing than lodgepole pine. The timber is similar to radiata pine.

Populus nigra var. *italica* (Lombardy poplar) is fast growing and the trees give good shelter if they are planted close enough. The timber will make battens.

Robinia pseudacacia is not quite as hardy as the other trees listed here, but is worth a little more care because of the durability of its timber.

Abstracted from the recommendations of W. H. Jollife, Extension Forest Officer, New Zealand Forest Service.

This Year's Royal

Visitors from the Four Corners of the Earth

This year's Show – the 110th in the history of the Royal Agricultural Society of England – was held for the fourth time in the city of Bristol. From this ancient port navigators once set sail for the four corners of the earth; this year it was a meeting place for agriculturists of many nationalities who came by road, rail, sea and air to see the latest in British agriculture and agricultural equipment.

Seen at the Show—The 1-ton Bonser truck

THE great Show this year occupied no less than 157 acres, with a further 140 acres as a car park to accommodate over 30,000 vehicles each day. All the hotel accommodation for many miles around Bristol was booked up a year ago. Inside the showground itself all the available space was taken up in a regular pattern of 590 stands, arranged in 13 avenues. Exhibitors of similar products were conveniently arranged in groups as follows: machinery and equipment, feeding stuffs, fertilisers, seeds, poultry equipment, dairy equipment and horticultural requirements. The following, for reasons of space, is a very brief account of a few of the exhibits which caught the eye:

A

The principal exhibit of *Allis-Chalmers (Great Britain) Ltd.* was their standard D-272 tractor, fitted with either a kerosene or a diesel engine, and live p.t.-o. There was a low model with an over-all height of only 3 ft. 8 in. for work in orchards and also a high model with a clearance below the mid-mounted toolbar of 27 in. for the cultivation of row crops. The power-adjusted rear wheels of all models can be set at any row width from 48 in. to 76 in. Also shown were a self-propelled gleaner and combine harvester, a one-man automatic pick-up baler and an all-crop harvester said to be capable of dealing with a hundred different crops.

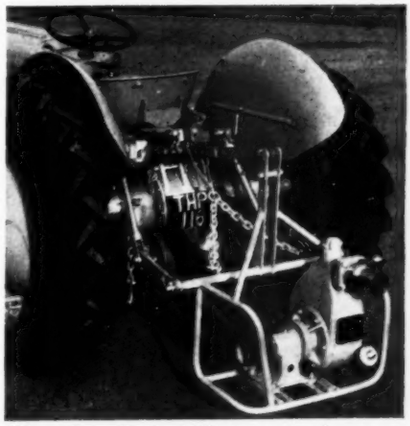
Atkinson's Agricultural Appliances Ltd. were exhibiting the 'Universal' manure, lime and fertiliser spreader and self-unloading trailer, the 'Spread-all' Mk. IV lime and fertiliser spreader and the Atkinson bulk spreader body for mounting on a lorry chassis. The 'Silo-aid', a power-operated tool for cutting silage, peat and farmyard manure, attracted considerable attention, as also did the 'Atko' p.t.-o. safety guard, which gives necessary protection to the tractor operator.

Automotive Products Co. Ltd. had a display of their components for tractors and agricultural machinery. The new Borg & Beck clutch will provide independent control of the main drive to the wheels and to the p.t.-o. from a single pedal. The 'Autolube' self-lubricating steering joint is revolutionary in its application to tractors. They were also showing the latest range of Lockheed mechanical brakes.

B

Being shown for the first time was the new S13 seed and grass drill, produced by *Bamfords Ltd.* This new implement incorporates a patent centrifugal feed mechanism to give precision drilling with a high degree of accuracy. A wide range of sowing rates is obtainable by an infinitely variable control, and it is claimed that it will sow the smallest seeds thinly and evenly in the most minute quantities. There was also the usual comprehensive display of their farm machinery and engines.

Barford (Agricultural) Ltd. had a remarkable range of their products on display – steam boilers for sterilising soil and dairy equipment; dairy utensils and equipment for cooking potatoes, roots, mash, offal and swill;



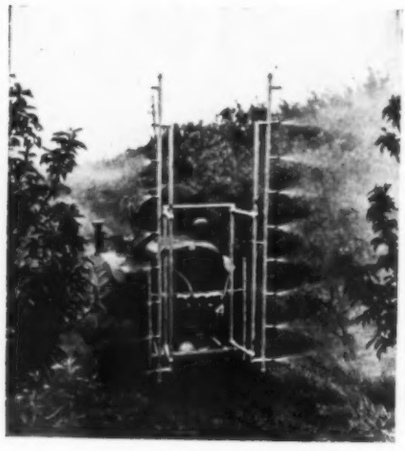
The Beresford 'Watermaster' pump attached to a Ferguson tractor is ready for the instantaneous coupling of a fire hose

small mechanical implements, such as the 18-in. 'Motomo' for cutting coarse grass and shrubby weeds, and the 'Atom 15', which can be used for 16 different purposes on farms, estates, market gardens, botanical gardens and research stations. Interesting attachments are the logging saw, the snow plough, a light trailer and a tipping truck. They were also showing the 'Lincol' ditch and dyke cleaner and the '75' diesel dumper.

Practically every need associated with the pumping of water could be met from the extensive range of pumps seen on the stand of *James Beresford & Son Ltd.* The most recent addition was the 'Watermaster', which is a 3-in. pump designed for attachment to the Ferguson or the Fordson 'Dexta' tractors. It was said to be capable of a suction lift of 25 ft. and of pumping up to 16,500 g.p.h. of clean or dirty water, such as liquid manures.

A new two-furrow reversible plough of revolutionary design was exhibited for the first time on the stand of *Bomford Bros. Ltd.* It has a main frame and legs of tubular construction and was shown as attached to a Ferguson '35' tractor. The 'Warwick' hedgemaker, first seen at the Smithfield Show, was again on view, but this time it was mounted on the Ford 'Dexta' tractor. Another product shown was their well-known high oscillator, primarily designed for use in market gardens.

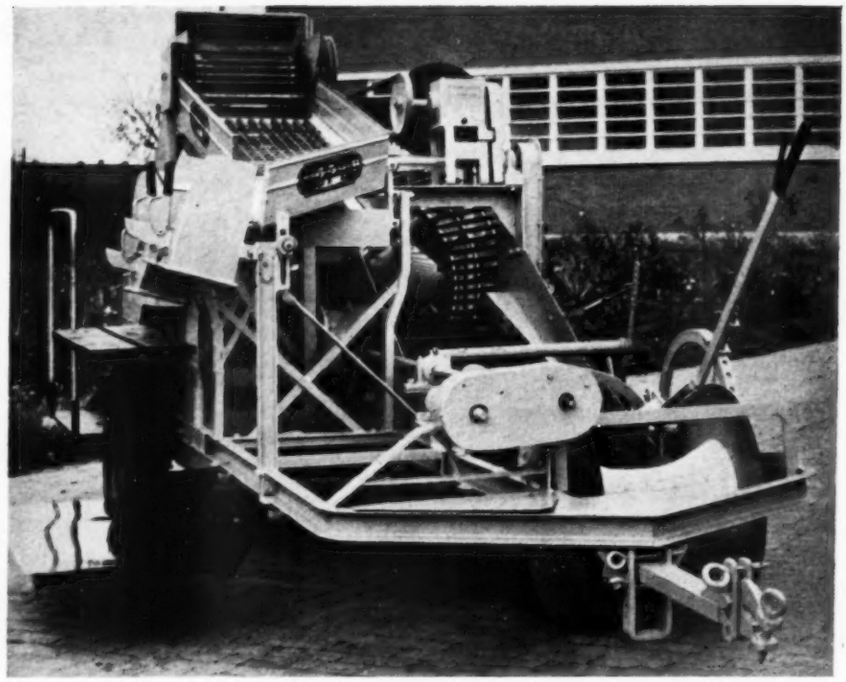
The one-ton 'Bonser' truck, exhibited by *Frank Bonser & Co. Ltd.*, is powered by a 5/6-h.p. Villiers petrol engine, although a petrol-paraffin vaporising oil conversion can be fitted, if required. The drive is to the rear wheels and the load is directly over them, so a high degree of traction in soft conditions is assured. Also of special interest to overseas buyers is their new 40-in. 'Agrotiller' rotary cultivator, mounted on wheels and suitable for attachment to the smaller tractors for close row work.



The narrow version of the new Evers & Wall medium-high-volume sprayer, for fitment to the standard David Brown 2D tractor, can be arranged for both vertical and horizontal spraying

The principal exhibits of the *David Brown Industries Ltd.* making their first appearance at the Royal were the Albion 'Hurricane' harvester, a multi-purpose machine with which one man can cut, chop and load a variety of crops unaided; the 'Albion' rotary tiller, which combines the action of a disk harrow and a rotary cultivator for the rapid preparation of seedbeds; and the 'Albion' pick-up baler, which gives side-delivery of the bale. In addition, there was a host of new implements and ancillary equipment.

The new 'Falcon' shoulder sprayer is light and compact



The S.P.Y. potato harvester has a special grading device and gives improved clod separation

C

On the stand of *C.A.V. Ltd.* there were shown a selection of diesel fuel injection equipment and electrical equipment for agricultural tractors and for stationary and portable engines. There were two interesting working models illustrating the operating principles of the diesel engine and the fuel injection system and also sectioned models of injection pumps, nozzles and fuel filters.

The *Caterpillar Tractor Co. Ltd.* introduced the first D8 tractor made in Britain, which was equipped with a No. 8A cable bulldozer. Accompanying it on the same stand were the Nos. 463 and 435 scrapers and Nos. 9A, 8S and 4A bulldozers. There were also interesting working cut-away models of the Caterpillar oil clutch and the D337 (F) engine and a large display of replacement parts.

The 'Loadmaster 800TC', a product of *Chaseside Engineering Co. Ltd.*, is a front-wheel drive torque-converter

shovel; extra traction is obtained because the torque converter places the load on the front wheels; there is no impact through shock loading and so clutch wear is reduced, engine stalling is eliminated and wheelspin is reduced to a minimum. Rear-wheel steering gives faster operating cycles and the driver has all-round visibility.

Clifford Cultivators were exhibiting a new model of their Mk. IV cultivator, a 16-in. version, powered by a 600-c.c. J.A.P. engine, together with the diesel model introduced last year. Included in the vast range of attachments we noted the quick-hitch 'Wessex' trailer, tool frame and plough. Other models on the stand included a standard Mk. I and a Mk. I narrow-unit conversion set for inter-row work at a cultivation width of 6 in.

The three principal exhibits of *J. W. & T. Connolly Ltd.* of special interest to farmers were the steel tyre conversions, the special tyres for rowcrop cultivation and the new pattern of tractor tyres, including the new 'Tractor Monarch'.

Displayed on the stand of *Cooch & Sons Ltd.* were machines for brushing, washing, drying, sorting and packing potatoes and also a universal machine for washing all types of root or bunched crops, such as celery, leeks, brussels sprouts, turnips, carrots, etc. There was also an interesting winnowing machine for cleaning grain and small seeds.

Cooper, Pegler & Co. Ltd. were exhibiting for the first time their new pneumatic knapsack sprayer, the 'Falcon' – a lightweight implement of robust construction and designed for the spraying of insecticides. They were also showing the full range of their spraying and dusting equipment.

The Mk. IV export model of the 'County Ploughman' crawler tractor was the principal exhibit of *County Commercial Cars Ltd.* This remarkable machine can exert a drawbar pull of no less than 5 tons. It is fitted with a 48-h.p. Fordson diesel engine with a rated engine speed of 1,800 r.p.m. It has no less than five forward speeds and also a high and a low reverse. The lowest forward speed is 1.43 m.p.h. and the highest is 5.04 m.p.h.

In addition to their normal range of galvanised steel grain storage silos, *Crittall Mfg. Co. Ltd.* were showing a new free-standing poultry feed bin with gravity feed, the dimensions of which are 14 ft. high × 10 ft. long × 5 ft. wide.

D

John Hughes Dexion Ltd. were exhibiting four sizes of 'Dexion' slotted angle used in the construction of framework, staging, benches, cages, cattle shelters and other agricultural equipment. The display also included a selection of accessories for use with this angled material, including a cutter which enables it to be cut quickly and accurately.

The latest introductions of *Drake & Fletcher Ltd.* were a combined atomiser-duster, known as the 'Mamba', and the 'MDG' mechanised dust gun. Also exhibited were the 'Penetrator 3', the 'Zero 50' and the 'Unimount' mistblowers; the 'LO Estate IV' trailer sprayer and the 'Mistifier' pressure-retaining knapsack sprayer; a Bruff hop-picking machine and a Bruff hop press.

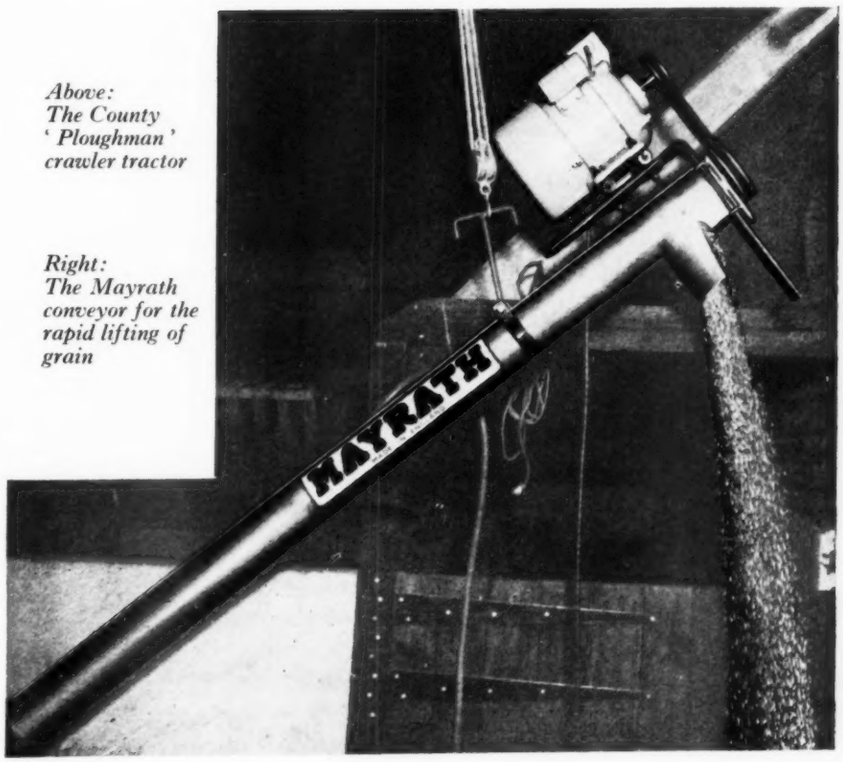
E

The centrepiece of the stand of *Robert Eden & Co. Ltd.* was the 1958 version of the 'S.P.Y.' potato harvester with improved clod separation and a grading device. A hinged share which permits stones to pass without injury to the machine has now been fitted. Also on show were three different models of the 'Goldland' reversible ploughs, the 'Dalco' combined hay rake, tedder and swathe turner, and two models of the 'Scotella' fertiliser distributor.

Visitors to the Show had no difficulty in locating 'Electricity Farm', which occupied a prominent position near the entrance. This exhibit was organised jointly by the *Electrical Development Association* and the *South-Western Electricity Board* to demonstrate the use of electricity and electrical aids on the farm and smallholding.

F

The 'Mayrath' portable auger conveyor, which handles over 60% of all American wheat, was on view on the stand of *Gordon Felber & Co. Ltd.*, who were also exhibiting their range of asbestos-cement farm buildings,



Above: The County 'Ploughman' crawler tractor

Right: The Mayrath conveyor for the rapid lifting of grain

Garden Plastics Ltd. introduced a plastic ' Roll Light ' cover for cold frames

deep-litter poultry houses and broiler houses.

Tyres of all kinds and for all purposes were on display on the stand of the *Firestone Tyre & Rubber Co. Ltd.* There were tyres for the front and rear wheels of agricultural tractors; tyres for use on the road or for when tractors are used on static power jobs; special tyres for horticultural tractors, and implement tyres with ribbed and patterned treads, designed respectively for free-rolling and driving wheels. There were also tyres for wheelbarrows and light trolleys.

G

Garden Plastics Ltd. were showing the ' Plybell Roll Light ', a reinforced plastic covering for giving protection to crops growing in cold frames, and also their ' Plybell ' PVC cloches.

A new 6-in. automatic self-priming pumping unit was shown by *Goodenough Pumps Ltd.* This set incorporated the new Lister ' HA ' air-cooled diesel engine and the whole assembly was mounted on a four-wheel rubber-tyred carriage with a swivelling drawbar. It was stated that this unit can handle thick mud and sludge and also debris-laden liquids containing up to 25% solid or abrasive matter in suspension.

H

Hayters Ltd. Besides showing their motorised rotary scythes and the 6-ft. trailing unit, they introduced this year for the first time their new 18-in. ' Hayterette ', a domestic model of ample power and of robust construction. The power unit of the new model is a 7F, 98-c.c. Villiers engine

The 26-in. self-propelled Hayter scythe is suitable for a rough cut in the tallest overgrowth and it will also give a fine finish to a lawn

with a recoil starter. No less than 12,000 cuts per minute are made by the four rotating blades, which are secured to a revolving bottom plate. The result, as demonstrated at the Show, was a neat, clean cut, which was executed with both speed and ease.

I

India Tyre & Rubber Co. Ltd. claim to provide a tyre for every type of agricultural equipment. Prominent among the exhibits was the ' India ' super-grip tractor tyre with open centre, which was said to be suitable for all surfaces, but particularly for clay and other soils where extra grip is necessary. The tread of this tyre consists of curved bars with self-cleaning properties.

K

Kent Engineering and Foundry Ltd. were showing five machines – the ' Conomist ' mistblower, which delivers from 3 to 100 g.p.h., is designed for hops, fruit trees, bush fruit and strawberries; the 'Powermist' tractor-mounted sprayer with a trailed tank and delivering from 20 to 250 g.p.h. is suitable for all crops; the ' Penetrator ', an automatic single- or double-sided sprayer and mistblower, is for hops and fruit; the ' Motoblo ', a shoulder-mounted power-driven mist-sprayer, dustblower or flamethrower; and the ' Motohawk ', a 3½-h.p. lightweight rotary cultivator.

The mechanised farm requires equipment for handling food, produce and other materials and on the stand of *Geo. W. King Ltd.*, who are specialists in this field, there were pulley blocks, chain hoists and an overhead runway for conveying food and litter. In addition, they were exhibiting their range of equipment for moving, storing and drying grain and special fittings for the dairy, the piggery and for cattle stalls.

L

The new ' Gardenmaster 34 ' shown on the stand of *Landmaster Ltd.* is a lightweight rotary cultivator, designed for small gardens. The standard blade assembly will dig to a depth of eight inches, both forwards and backwards, and will hoe and aerate the top-soil. Extra attachments include heavy

The India ' Super-Grip ' tractor tyre with open centre tread

blades for a compacted soil, a lawn mower assembly and a hedge trimmer, powered by a flexible drive. The larger and more robust ' Gardenmaster 80 ', and the Landmaster ' Colwood ', a machine for inter-crop cultivation on

intensively-cultivated land, and the robust Landmaster 'Hawk', fitted with power-operated steering for hard work on large areas, were also on show.

The new Lanz self-propelled combine harvester, the MD18S, was shown for the first time on the stand of *H. Leverton & Co. Ltd.* Its outstanding feature was its compactness; it is comparatively small in size – with a 6 ft. 6 in.-cut – yet it embodies some of the features of the larger MD260S combine, which was also on show, together with the 'Combi' binder with a 5 ft.-cut, the new side-delivery rake, the NR800, a potato spinner, and a number of tractor implements.

M

Massey-Ferguson exhibited many new implements including combines and balers, their 13-tine tiller, a new two-furrow reversible plough, the new forager, a set of mounted disk harrows and an automatic potato planter, in association with their '35' and '65' tractors. The most outstanding 'first-time' exhibit was of course the new forager, which was demonstrated at the National Silage Demonstration. Its special characteristics are that it cuts the stubble clean and no dirt is picked up.

For faster farming, *Midland Industries Ltd.* were showing various models of their lifters, loaders and buskrakes for attachment to the Fordson Major, the International B250, the Ferguson FE35 and the Fordson 'Dexta' tractors.

The 'Powermist' tractor-mounted sprayer in full blast

Up to 80 bags of produce a minute were automatically sealed with pressure-sensitive tape on the stand of the *Minnesota Mining and Mfg. Co. Ltd.* The banding of rhubarb, bananas, celery, asparagus, cauliflower and lettuce with a brightly-coloured tape, which adhered at a touch, added greatly to the eye-appeal of the products as shown ready for marketing. To speed up the packaging of produce such as vegetables, fruit, seeds and bulbs in polythene bags there was the new 'Scotch' automatic bag-closing machine.

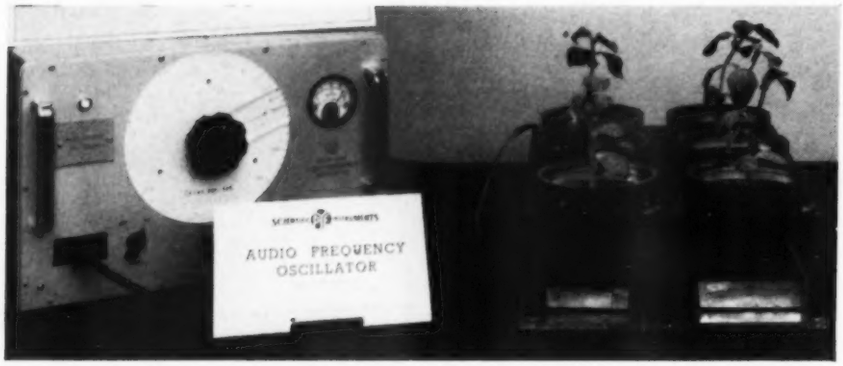
The products of *Mitchell, Colman & Co. Ltd.* fall into two main groups: crop-handling machines and silage machines. Among the 14 machines on view, the following were shown for the first time: an overhead, tractor-mounted, tipping container for loading sugar-beet and similar crops, the 'Comet', a flail-type forage harvester, and the 'Rotex' silage blower for delivering silage into a pit or byre. The 'Combi' combine harvester is a new self-propelled machine powered by a Mercedes diesel engine which gives a 6-ft. 6-in. cut.

N

In addition to their standard tractors, the *Nuffield Organisation* were showing various attachments, ranging from the Robot post-hole borer and an Aldersley weeder to a Ransome's reversible plough and an R.B. lime spreader. There were also some interesting sectioned models and the star of the show was that of a Universal 'Three' tractor. In addition there were models showing the working of the p.t.-o. and the hydraulic lift.

Since the last Royal, *Nu-way Heating Plants Ltd.* have introduced a new range of oil-fired hop-drying units and

The 'Nu-Way' oil-fired hop-drying unit, model Y.24E



The Pye audio-frequency oscillator to keep insects on the plant without restraint

this range was represented by a Y24E unit, intended for a 16 ft. sq. hop kiln or a 3-ton-per-hour grain drier. It is fitted with the latest type of burner, which gives correct flame conditions over a wide range of outputs. Also on the stand was a 3-ton model, oil-fired ' N-H ' tipping tray grain drier.

O

The ' Smallford ' range of vegetable, potato and tree planters were shown by *Jack Olding & Co. Ltd.*, together with grain-cleaning machinery, the 'Angus' potato digger and the ' Hatfield ' manure spreader. The ' Smallford ' potato planter was shown in the new tractor-mounted model. The tree planter can be used for planting rose stocks, privet and quickthorn.

P

Ferguson, Allis-Chalmers and Fordson tractors fitted with Perkins engines were on the stand of *F. Perkins Ltd.*, together with the new 1.6-litre ' Four 99 ' diesel engine and other engines in their range of agricultural engines. This new engine was said to be particularly useful for small tractors and for small self-propelled combine harvesters where a constantly accurate speed is required.

F. W. Pettit Ltd., who are specialists in trailers, had an impressive display of three-way hydraulic tipping trailers with steel and wooden sides, wood reinforced with steel, and detachable frames for silage.

An exhibit which aroused considerable interest at the recent Crop Protection and Pest Control Exhibition was the *W. G. Pye* audio-frequency oscillator, a shock device for persuading insects to remain on a plant and not move on from one plant to another. This was also shown at the Royal and again attracted considerable attention.

The Howard ' Rotavator ', model ' E ', Series 11, has the ' Selectatilth ' gearbox

R

The improved ' Whitsed ' model RB harvester, which was exhibited by *Root Harvesters Ltd.*, is equipped for the bulk loading and bagging of potatoes and also for harvesting carrots.

The very latest ' E ' series 11 rotovator was shown on the stand of *Rotary Hoes Ltd.* It incorporates a remarkable ' Selecta-tilth ' gearbox, which enables the operator to set the machine for any required cultivating tilth in 30 seconds; another feature is its quickly adjustable depth control skid. Another interesting new development seen was the Howard-Allman ' Auchincruive ' soil mixer for the control of potato root eelworm by the incorporation of diatomaceous dust containing yellow oxide of mercury into the soil.

The exhibits of *Ruberoid Co. Ltd.* included a comprehensive range of their building materials and horticultural sundries. Their new ' Starex ' roofing for large semi-permanent farm buildings gives complete protection as well as an attractive appearance. Their new ' Starex ' unbreakable flower pots are flexible and require no sterilisation, soaking or cleaning.

Spare parts and components for agricultural trailers were shown on the stand of *Rubery Owen & Co. Ltd.*, together with an arrangement of fabricated components and pressings and various assemblies.

S

S.K.H. & Son had two new items of equipment – the ' Sieling ' down-the-row thinner and the S.K.H. grain drying unit. In addition, they were showing the ' Salopian ' power-driven manure spreaders, the ' Evenspreader ' and the ' Quickspreader ', a tractor-drawn manure cart and a tractor-mounted transport box for light haulage jobs around the farm. Again on view were the ' Hudson ' three-disk plough, down-the-row thinner and the twin disk hoes for mounting on the toolbar of the tractor.

We noticed that *John Salmon Engineering Co. Ltd.* had made two major modifications to their beet harvester in the form of an extended top elevator for improved lifting and a device in the rear hopper for quick cleaning. They also showed their latest cleaner elevator tractor mounted on three-point linkage.

On the stand of *Salopian Engineers Ltd.* were to be found various items of equipment for the dairy and for the securing, enclosing and penning of poultry, sheep, pigs, cows and bulls.

Where a large permanent stand is required for agricultural shows, plastics have many advantages over other

materials. A plastic stand can be made in attractive colours which will not fade or stain; plastics will remain firm against rough weather, and will not tear or absorb rain. This material is not inflammable and the sections can be easily dismantled and stored; they are light and can be moulded to any shape, as required. In consequence, the stand of the *Shell Chemical Company* attracted attention not only because of the interesting range of exhibits of agricultural chemicals, but also because of their most attractive setting in what was probably the largest plastic structure in the world. This permanent stand, which had a diameter of 70 ft., was designed by *Sir William Crawford and Partners Ltd.* and made by *Microlas Ltd.*

Sigmund Pumps Ltd. were showing their extensive range of high and low pressure irrigation equipment and pumps suitable for the planter, the farmer and grower. A new innovation is ' Selfix ' coupling. This new type of express coupling is designed to fit the irrigation pipe line without the need for any permanent attachments. The pipe is gripped firmly by means of a rocking bolt and the resulting joint is water-tight, even under very high pressures. No special tools are needed and the coupling can be quickly and easily removed from any length of pipeline. In addition to the original STIP tractor irrigation pump, this company was exhibiting a range of agricultural pumps for irrigation and drainage, for washing down vehicles, for fire-fighting, and for general supply of water to the farm. They ranged from a small 1½-in. unit with an output of 1,000 g.p.h. to an 8-in. unit which can deliver up to 110,000 g.p.h. The ' Portapak ' self-priming, portable pump is the ideal economical unit, giving both efficiency in operation and economy in initial and subsequent running cost.

The centre attraction on the stand of *Messrs. Silorators Ltd.* was the Mk. III ' Silorator ' forage harvester, a tractor-towed, p.t.-o. driven machine. The new hydraulic castor unit is a device for adjusting cutting height and there is improved intake and delivery. Also incorporated is an effective silencer and a new type of guard for the p.t.-o. Among other important items exhibited were a new clover seed attachment and a new kale attachment.

Stanhay Ltd. had a comprehensive display of their agricultural lifting and earth-moving machinery and accessories. Their seed-spacing drill is designed for sugar-beet, mangolds, turnips, swedes, kale, peas, maize, groundnuts, soya bean, sorghum and jute. The hoist and loader is a hydraulically-operated, swivelling jib for attachment to a tractor, which can be fitted with a variety of grabs. The ' Ditchmaster ' is for cleaning ditches and excavating new ditches.

Steel Fabricators (Cardiff) Ltd. had a remarkable display of their hydraulic loading attachments – a hay sweep, grapple and manure forks, buckrakes, push-off stacker, dirt and root crop buckets, scoops, bulldozer blades and even a hedging attachment exhibited as standard attachments to their ' Horn-Draulic ' loaders. The ' Shawnee ' digger, which was also shown, is a very powerful machine which can cut through the roughest and toughest ground; it is designed in four tailor-made models for attachment to the Fordson Major, Ferguson ' 35 ', the Nuffield and the International B250 tractors.

The new band rack saw, type VB48/VJF, seen in action on the stand of *Stenners' of Tiverton Ltd.*, has a feed speed of 200 ft. per min., which makes it possible to increase the output of sawn timber by at least 25%. Another interesting machine of theirs, shown in the Forestry Section of the Show, was a transportable log bandsaw, type VXJ. This machine can be taken from site to site in the woods and forests and set up in a matter of 30 seconds. It will convert round timber into boards on site, and so will simplify handling and reduce transportation costs.

T

Taskers of Andover (1932) *Ltd.* exhibited a wide range of agricultural trailers and wagons and other agricultural implements, such as the Paterson buckrake, earth scoop and grader blade, a rotary slasher and feed mincers. Shown for the first time was their 3-ton ' Universal ' – a two-wheel hydraulic tipping trailer, fitted with deep sides and removable extensions specially designed for carrying silage.

Teles Smith Ltd. were exhibiting a range of fast-cutting chain saws for one-man and two-man operation, and powered either by electricity or by a petrol engine. The two-man saws can be comfortably operated by two men and do the work of a gang; it can be swivelled to any angle and cuts with ease and speed. The ' Tiger ' hedge-cutter, powered by electricity, is par-

The Taskers hydraulic tipping trailer is fitted with movable extensions for handling silage

The Woolley portable and motorised sack lift can raise 3 cwt. at a time

ticularly light and handy.

Implements on display by *W. A. Tyzack & Co. Ltd.* included an interesting assembly of cutting and wearing parts of agricultural implements and tools, and a representative range of their ' Horseman ' brand agricultural hand tools.

V

Combine harvesters were the principal exhibits on the stand of the *Viking Machinery Co. Ltd.* The high-capacity ST67 model combine was equipped both for direct bagging or for delivery into a tanker. Other interesting exhibits were the TRS side-rake and hay turner, the TP tractor-mounted potato digger, the TKT tractor mower and the BS sugar-beet harvester for mounting on a tractor.

The *Villiers Engineering Co. Ltd.* and *J.A.P. Industries Ltd.* have now joined forces and their combined display of engines, ranging from a tiny 34-c.c. two-stroke unit, developing $\frac{1}{3}$ b.h.p. to an 824-c.c. twin-cylinder four-stroke engine with a peak rating of 15 b.h.p., which made an impressive display, represent a valuable contribution to agriculture and horticulture.

W

The latest ' Clydebuilt ' product of *Innes Walker (Engineering) Co. Ltd.* which was on show was the ' Speedifit ' tractor cab, specially designed to come on and off in one minute. This is certain to have a special appeal in tropical countries, as it will now be possible to avoid the build-up of heat from the engine and the sun by the quick removal of the cab after a storm has passed.

Seen for the first time on the stand of *John Wallace & Sons Ltd.* was a new semi-mounted elevator potato digger for attachment to tractors which are not powerful enough for the fully-mounted digger. The AV2 manure spreader, first seen at Smithfield, had several interesting new attachments to increase its usefulness and, in addition, the ' Exact ' down-the-row thinner, which was shown, can be adapted for four-, five- or six-row use.

Messrs. Whitlock Bros. Ltd. had a big display of grain-handling equipment on their stand. Only recently introduced was a combined mill and mixer, a small and compact unit which can conveniently fit into a corner of a building. In addition, they were showing their dump wagons and earth-moving equipment and a grab for digging trenches and irrigation ditches.

The modern farmer requires to have a workshop to do small running repairs and so save himself lost time during rush periods. *Wolf Electric Tools Ltd.* were showing on their stand a selected range of electric tools. These included the Wolf $\frac{1}{2}$-in. two-speed drill, a portable machine for steel, wood and brick; the Wolf 7-in. heavy-duty sander for sharpening cutter blades, rust removal, grinding welded repairs and surfacing timber, metal and stone; their heavy-duty 7-in. saw and their 6-in. double-ended grinder, which can be fitted with a wire brush for removing rust and carbon deposits.

One of the principal exhibits on the *Wolseley* stand was the ' Merry Tiller ' garden cultivator. In the demonstrations, the same machine was used for lawn mowing, for cultivation, for sawing logs and for hoeing and ridging and these conversions were all made in a matter of seconds. A 14-in. chain saw which will cut logs up to 16 in. in diameter was shown for the first time, together with a full range of electric fencing equipment and the Wolseley ' Multimill '.

J. W. Woolley & Co. Ltd. were showing their grain-drying and handling equipment, cattle feed mixers, dairy sterilising equipment, the ' Electrobloc ' steam raiser and a motorised sack lift. The ' Dial-a-matic ' timing device is an important new device which they have fitted to their in-tray grain driers.

Wright Rain irrigation systems are in use in all parts of the world for improving such crops as grass, potatoes, sugar-beet and other root crops; tree and bush fruits; hops and horticultural crops; and tropical crops, such as tobacco, cotton, sugar-cane, tea, coffee, bananas and citrus. Their latest introduction – the H-3 tractor irrigation unit, designed to operate sprinkler irrigation schemes up to 100 acres, was the centrepiece of their stand.

A running repair – sharpening a baler ram knife with a high-speed Wolf sander

Dates in Pakistan

Above: A date orchard in the province of Sind

Right: Date harvesting. Dates grow in bunches of about 2 lb. There are generally four to six bunches on a palm

Although date palms have been grown in Pakistan from time immemorial, it is probable that the armies of Alexander the Great in 327 B.C., and later in the 7th century the invading army of Mohammed Bin Qasim*, contributed to their present abundance in the Indus basin, by spitting out the stones of their frugal ration as they stopped between marches.

There are now in Pakistan about 1,750,000 date palms, found chiefly in the Province of Sind, the Punjab, Baluchistan and North-West Frontier Province, which yield 9.58% of the world's total production of dates. [Iraq, the largest producer, produces one-third.]

Variety, soil and climate have a great effect on the yield, size and colour of the dates. The season lasts from June until the middle of October, with September the peak month. Sometimes early heavy rains, followed by cloudy conditions, cause an abrupt end of the season. Light showers have little effect on the fruit, if followed by sunshine, but heavy rain can cause the fruit to loosen prematurely.

Most of the dates produced in Pakistan can be dried and preserved and the growers can choose whether to send the fresh dates to the market or to dry and store them for marketing later.

To the uninitiated, harvesting appears a hazardous operation. A man climbs up the tree by means of a device called *Tor*. This consists of a strong band of cotton which encircles his waist and the palm in the manner of a sling. Monkey fashion he clambers to the top and severs and gently lowers the bunches of dates from the tree with a rope.

There would be much advantage in developing the date industry in Pakistan on a scientific basis and recommendations are being considered by the Government. It is proposed that:

1. Trainees should be sent abroad to learn improved methods of picking, curing, packing and preserving.

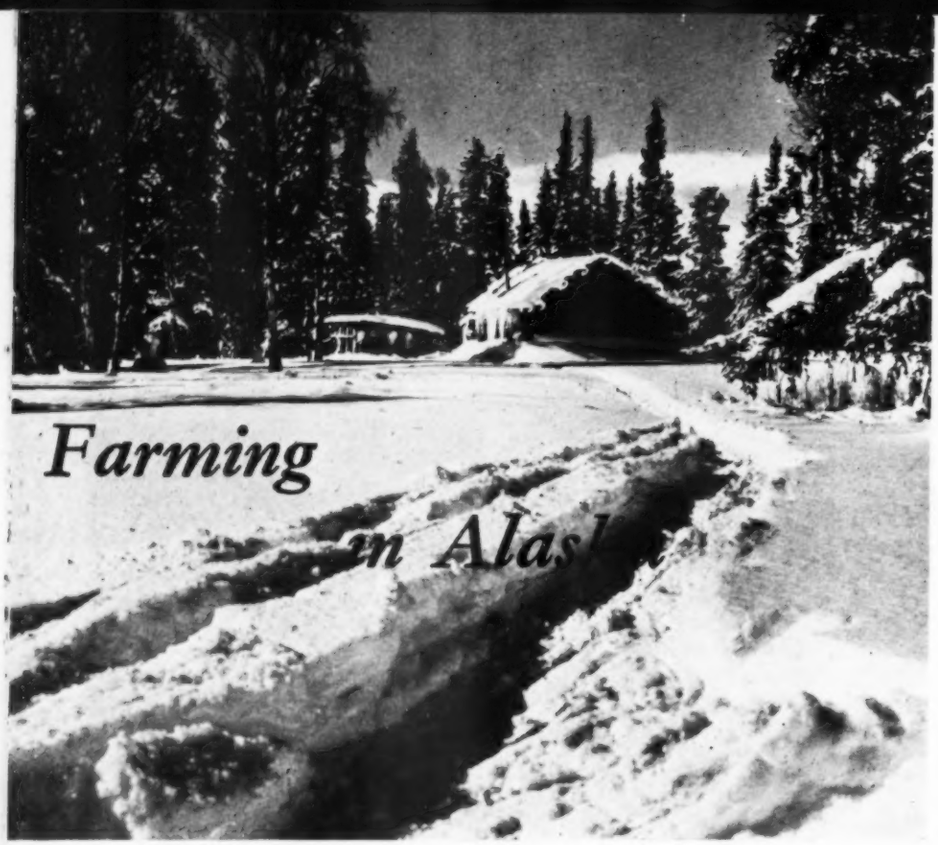
2. Date research stations should be established in the main date-growing areas.

3. The main commercial varieties of dates should be officially defined and fumigating plants should be set up in the producing areas.

The date is a valuable source of nutrition and the staple food of the Arab peoples. Increased production would not only mean more food in the fight against under-nourishment, but would also constitute an important source of agricultural income to Pakistan. At present she produces about 21.57 lakh maunds†. Of this, about 19.41 lakh maunds is marketable surplus and is sold, fresh or dried, on home and foreign markets, and the remainder is retained by the growers for their personal use.

* The Arabs, inspired by the teachings of the prophet Mohammed, attacked and overthrew the Persian empire and established Muslim power in the valley of the Indus.

† Lakh maund: 8,230,000 lb.



The 49th State of the U.S.A.

FARMING in Alaska is usually on a small scale. The limiting factors are first the lack of capital or credit and secondly the lack of buildings and equipment.

Two peculiarities are the youth and inexperience of the farmers and the rapid turnover of farm ownership. Many farmers have been lured away by highly paid jobs created by defence construction operations at Anchorage. The resulting increase in population has also created a temporary boom in land values that may have encouraged farm sales.

Acreage and Production

Between one and three million acres of Alaska's 586,400 square miles of land are suitable for cultivation, but only about 14,000 acres have been cleared, crops have been harvested from about 12,500 acres and another three to five million acres are suitable for limited grazing.

The farm value of food produced in the territory last year was about $3 million, the retail value being about $6 million. Milk led in dollar volume, followed by potatoes, poultry, vegetables and cattle.

The areas with most agricultural activity are around Palmer in the Matanuska Valley north of Anchorage, and around Fairbanks in the Tanana-Chena Valley. There is also some production near Anchorage and in scattered locations on the Kenai Peninsula.

The Matanuska Valley

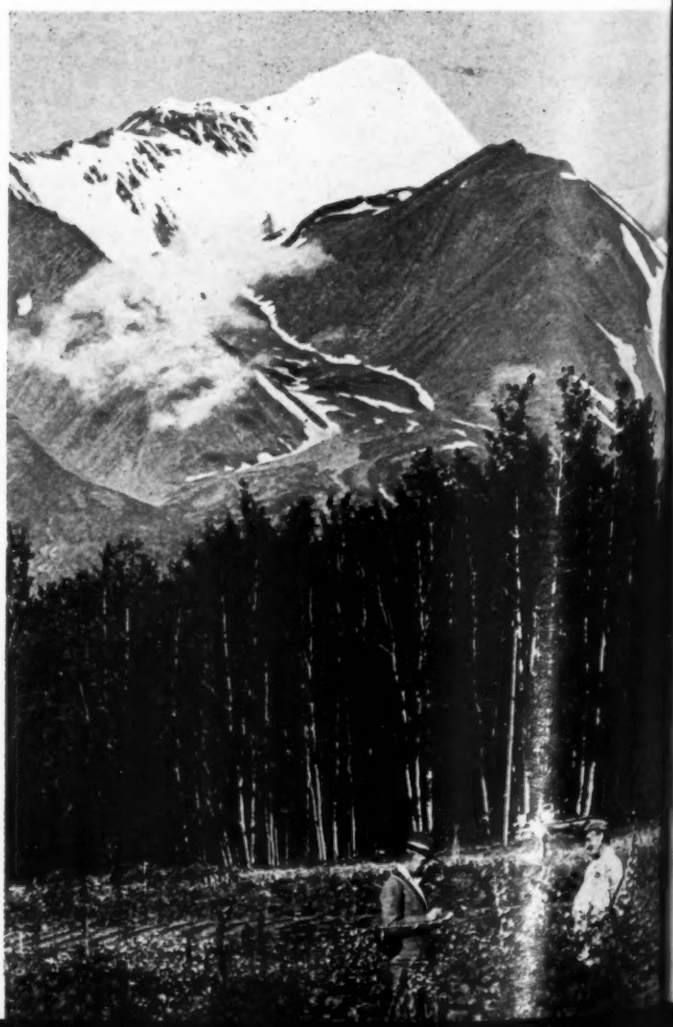
Location, transport facilities, climate and soils combine to make the Matanuska Valley one of the most promising areas for agriculture.

About half of all the foodstuffs grown in Alaska come from here. Its farms, aided by the Matanuska Valley colonisation project in 1935 with its Federal grant of credit of $5,400,000, have prospered in recent years, particularly since the war, although today only 30 of the original 202 colonists remain on the land.

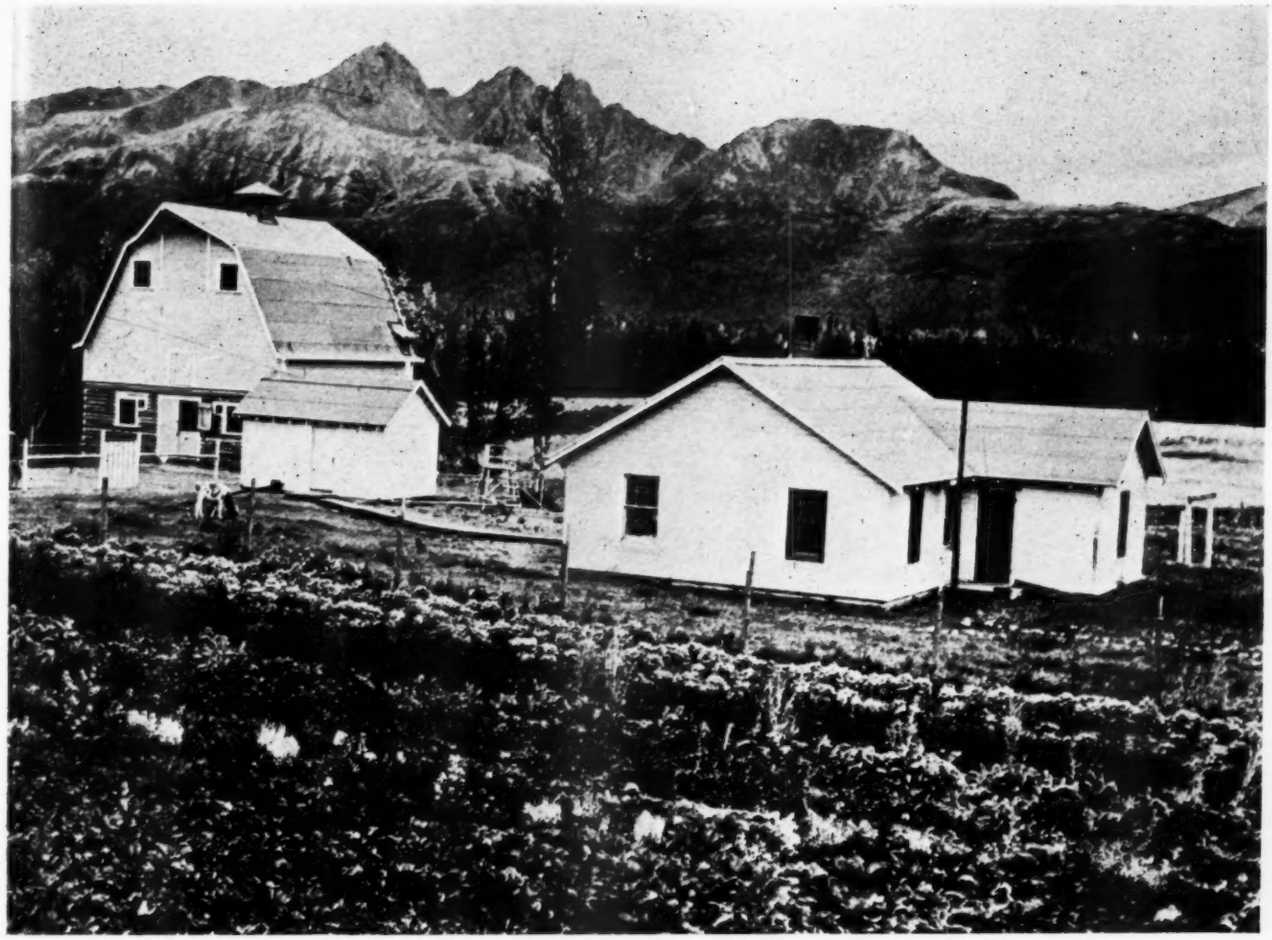
The valley is a lowland area in south-central Alaska between the Talkeetna Mountains on the north and the Chugach Mountains on the east and south, through which runs a railway, constructed in 1916, to which nearly every farm has access.

The Matanuska Electric Association furnishes electricity for Palmer and the entire valley and most farms now have electricity.

Climate.—The winters are not so cold here as in the Fairbanks area in central Alaska, but summers are not quite so warm and sunny; the rainfall is slightly higher and the growing



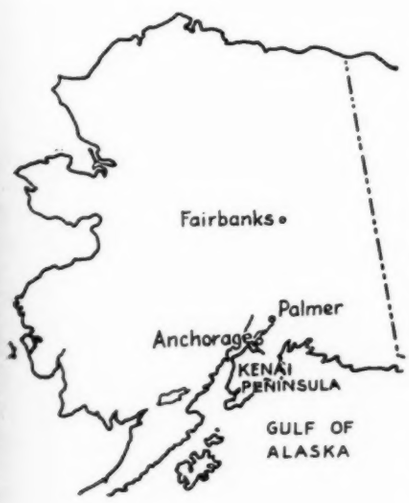
Inspecting the crops at a horticultural station



A typical farm in the Matanuska Valley

season is a little longer. The average July temperature is 57·7°F, the average January temperature is 12.6°F. Average annual precipitation is 15.6 in. and the average growing season is 108 days. In June and July there is the advantage of a long day with practically no darkness.

Soils.—The soils have been developed from water- and wind-sorted materials under cool and moist conditions. Permanently frozen conditions have been found only where drainage is inadequate and a dense plant cover is present. Despite this, the subsoil is too cold for the deep extension of plant roots. Most of the soils have developed from silty, very fine, sandy materials laid over a base of water-sorted glacial drift, consisting of mixtures of gravel, cobbles and sand in varying proportions. The variable soils, on the whole, are responsive to good soil management, but they are unable, even immediately after clearing, to give high crop yields without heavy applications of fertiliser. Some soils are extremely shallow and some susceptible to blowing. Wind erosion is, in fact, a serious threat to farmlands in some parts of the valley.



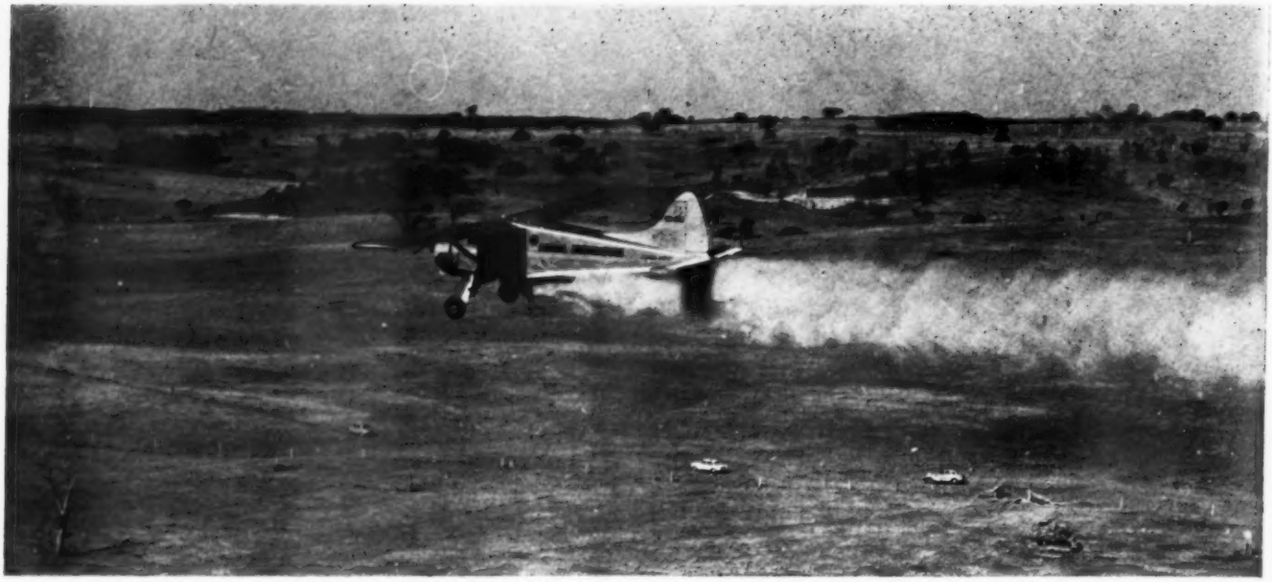
Farming activities

Dairy farming in the Matanuska Valley has increased most spectacularly in recent years in response to the demand in nearby Anchorage resulting from defence activities. Although dairy farming requires larger capital outlays than other kinds of farming, the steady monthly income has the attraction of providing greater security and stability.

A small number of beef cattle, hogs and sheep are raised. Consumer demand for fresh beef is good, but the huge requirements for winter feed and the expense of growing hay and grain, the high cost of land clearance and lack of slaughterhouse facilities are limiting factors to stock farming production.

Hot-weather crops, such as tomatoes and cucumbers, are raised in greenhouses. Bush fruits produce large yields of excellent quality. Oats, barley, wheat and Canadian field peas are grown. Brome grass is becoming popular for hay, silage and pasture.

[Further information regarding farming in Alaska may be obtained from the Alaska Agricultural Experiment Station at Palmer, Alaska, and advice regarding settlement in the Matanuska Valley can be obtained from the Alaska Rural Rehabilitation Corporation it Palmer.]



Aerial Top-Dressing

A ' look-and-learn ' field day organised in New South Wales recently by a dozen big agricultural companies was attended by more than 1,000 farmers.

Staged at ' Gundowringa ', a 6,000-acre property about 120 miles south of Sydney, the field day was designed to show the benefits of planned pasture improvement. Visitors were shown a narrow strip of untouched land which was near-barren, eroded and useless. Alongside this was fertile land covered with good-eating grass – the result of planned soil improvement – providing a startling contrast.

The property, farmed by C. E. and H. F. Prell, showed what happened when man gave nature a helping hand.

A fleet of light aircraft showed the latest methods of aerial top-dressing and the advantages of bulk field dumps of superphosphate over the use of bags. The small planes landed beside the field dumps and were refilled by mobile tractor loaders. It took only a few seconds before each plane was again in the air and spreading fertiliser across the pastures.

The fertiliser can also be loaded into truck spreaders for ground applications.

The site of the dump had been treated with a special oil-base sealer to keep out dampness, and portable walls and hatch covers also erected.

In 1904, when the property was first acquired, it was described as ' supporting wiry native grasses, virgin and ring-barked forest and fallen trees intermingling with the meagre grass supply; the land carried less than one sheep to the acre and stock condition was poor. The average wool cut was between 6 and 7 lb. for each sheep. Today the picture is vastly different. The improved pastures now carry more than two sheep to the acre – plus lambs – and the average wool clip for each sheep is more than 13 lb.

Where once the soil was light and poor, it is now dark and rich. Where once the soil had been washing away, now even the steepest hills are covered with pasture that knits the earth together like a surgeon's stitches.

Loading fertiliser on to a mobile tractor loader from a bulk field dump. The mechanical shovel scoops it up and (left) *transfers it to the aircraft*

New Publications

The World's Sugar

By V. P. Timoshenko and B. C. Swerling. Pp. 364. Stanford University Press. London: Oxford University Press. 1957. 8*s*.

The Food Research Institute of Stanford University have published a number of important books on the management of agriculture and food in various countries during the second world war. The present volume in the series is in many ways more comprehensive than its predecessors because it treats sugar on an international rather than a national basis and provides a history of the evolution of the sugar industry during this century in which the two wars are considered in normal perspective. The book should be widely studied not only by students and economists who will readily appreciate its great value, but also by those who may be called upon to guard their country's interests while bringing to fruition future negotiations to stabilise this world-wide industry.

Following an introductory section, the book is divided into two main divisions. The first of these concerns sugar crops and agricultural development in which methods employed to increase yields are discussed and the internal structure, organisation and control of the industry outlined. It includes two intensely interesting chapters on mechanisation in sugar-beet and cane fields. The authors show how new technology has converted sugar-beet from a labour-intensive crop to one requiring skilled machine operators and considerable capital investment in specialised machines. They explain the important part that cane-breeding has played in the evolution of present-day cane varieties. Whereas, however, maintenance of yields of sugar from cane is found to depend largely on the cultivation of suitable varieties, high sugar yields from beet can only be obtained by heavy manuring and a high degree of factory efficiency.

Although interesting, the foregoing becomes merely the background for the final section of the work which, under the title 'Sugar Policy in Peace and War', leads the reader through the complexities of organisation and control of sugar production and marketing and describes the schemes adopted to establish sugar-growing industries in America, the U.K., Continental Europe and the Soviet Union, and the effort to maintain supplies during the war years, followed by the attempt to establish a world sugar policy.

Almost the whole of the text is factual; the authors make skilful use of information from many sources (which are carefully annotated), but usually they do not offer their own judgment on any issue, although occasionally they interpose a sentence or so which leaves the reader in no doubt as to their personal views.

In the final chapter they discuss the free market and the International Sugar Agreement of 1953, which they stigmatise in no uncertain terms. They point out that while the Agreement is easier to justify in the abstract and holds fewer dangers than is common with commodity agreements, the widely acclaimed approval and expressed hopes of its sponsors and the fears of its detractors are equally likely to be disappointed. In fact, they conclude that no clause effectively dealt with basic problems, whether by opening protected markets, reducing margins of protection, or preventing expansion of subsidised output and further contraction of the free market. Contrary to views held by many authorities, including F.A.O., which look to the Agreement as a price stabiliser, the authors conclude that the Agreement makes no contribution towards solving the fundamental difficulties of the industry, for while it accepts as its main objective the reconciliation of essentially irreconcilable national sugar policies, it ignores the underlying difficulties. 'In the 20th century, as in the 19th, policies more than economics are at the root of the international sugar problem'—a bitter but perhaps irrefutable conclusion in conformity with the data and arguments advanced by these distinguished collaborators.

D. H. GRIST

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Technical Books,
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London, N.W.1.
Telephone: Euston 5911.

Other miscellaneous publications reviewed should be obtained direct from the addresses given.

The Aphidae (Homoptera) of East Africa

By V. F. Eastop. Pp. 126. London: H.M. Stationery Office. 1958. 27*s*. 6*d*.

This book on the Aphidae of East Africa is another in the series of Colonial Research publications which deal with research studies in the colonies and which are financed from Government sources.

The importance of Aphids as vectors of virus diseases of plants in E. Africa as in other parts of the world has been frequently emphasised. Nevertheless, as regards E. Africa little taxonomic work on the Aphids of that part of Africa has been carried out apart from that recorded in a few scattered descriptions of new species in the literature. Furthermore, no account exists of a world fauna, nor is there a complete account of the Aphis fauna of any part of Africa south of the Sahara.

The present volume is divided into three main sections. In the first section the systematics of Aphids, indigenous Aphids, sexual forms, flight, methods of collecting and preserving, as well as their terminology and morphology are dealt with.

Taxonomy comprises the whole of the second section. It includes a list of species, keys to the sub-families, tribes, sub-tribes, genera and species. The wealth of ecological facts, in relation to the species given in this section, reveals the great amount of painstaking work done by the author. Supporting this section are 63 excellent line drawings of morphological details. These figures (an indispensable item in any good taxonomic work) naturally enhance the value of the present study.

The third section lists the host-plants and is followed by a comprehensive list of references.

The purposes of the report are three-fold. Firstly, the intention is to provide a means of identifying those

Aphids known to occur in East Africa; secondly, to facilitate the identification of a few other species, not known in East Africa, but which occur in adjacent territories or have an almost world-wide distribution; and thirdly, to collate all available information on the biology of these insects. In all this, the author, without doubt, has succeeded.

A few printers' errors have been overlooked, but this omission does not detract from the obvious value of this contribution to the knowledge of the Aphidae.

N. C. E. MILLER

Methods of Weed Control

By E. A. Helgeson. Pp. 189. Rome: FAO. 1957. $2.00 or 10s.

The present publication covers mechanical and cultural methods as well as chemical means of weed control; thus by indicating the complementary nature of these methods, the indiscriminate use of the chemicals may be avoided. The main emphasis is on practical weed control methods, and the aim is to provide a ready reference for investigators who do not have access to a sufficient range of literature on this subject.

In one chapter the chemicals used for the control of weeds are discussed and in the next the different types of equipment now used. Following this, there is detailed consideration of the methods used for the control of aquatic weeds, brushwood and woody plants; then the selective control of weeds in grasslands, in field and horticultural crops is dealt with; and finally certain important weeds are considered individually. Altogether, a most useful and practical contribution to the literature on the subject.

F. C. COOKE

Commonwealth Economic Committee

The 1958 edition of 'Industrial Fibres' contains summaries of production, international trade, consumption, stocks, prices and customs duties for cotton, flax, jute and jute manufactures, sisal and other hemps, coir and kapok, amongt other fibres. Developments up to the close of the 1956-57 season are covered in detail and comparisons are given for earlier post-war seasons as well as for the average of the five immediate pre-war years. In each section particular reference is made to the part played by Commonwealth countries, and to their interests whether as producers or consumers.

World production of the chief industrial fibres rose for the third successive season in 1956-57 to a new record level. The increase applied to all the main fibres except cotton. Aggregate fibre production in the free world during 1956-57 was very slightly higher than in the previous season, and the estimated total of 28,300 million lb. was the largest ever recorded. Total fibre production in the Commonwaelth continued to rise, appreciable increases in cotton, sisal, and jute being recorded compared with the previous season, although flax output continued to fall.

Obtainable from the Commonwealth Economic Committee, London, price 5s.

OEEC Publications

Control of Pests in stored agricultural products with special reference to grain is a report on a survey carried out in North and South America and in the Mediterranean area. It has been estimated that losses in stored grain range from over 2% in temperate zones to at least 10% in the tropics, and in publishing this report the European Productivity Agency hopes that it will draw the attention of the appropriate national authorities and international bodies to the need to take steps to reduce losses. The report is indeed a valuable contribution to knowledge on the subject of prevention and control of infestation in stored products and merits a wide circulation. Price 11s. 6d., $2.00 or 700 F. fr.

Applications of Atomic Science in Agriculture and Food, is a report of a mission to the U.S.A., the members of which were seeking the views of U.S. scientists regarding the application of atomic tools in research work connected with problems in (*a*) soils and plants; (*b*) animal science; (*c*) radiation biology; and (*d*) food preservation. On return they were to be able to develop research work on atomic science in agriculture in their own countries and train technical personnel in the basic techniques leading up to the use of isotopes. The programme of the mission is fully reported. Price 6s. 6d., $1.25 or 400 F. fr.

Agricultural Advisory Services in Europe and North America is a report of the International Working Conference of Directors and senior officers of Agricultural Advisory Services held in June 1957. The conference report and recommendations constitute the first section, followed by the texts of the papers presented. Price 12s., $2.00 or 750 F. fr.

Advisory Work on Rural Home Economics in Europe. Price 4s. 6d., $1.00 or 300 F. fr.

Fertilisers, Production, Consumption and Trade in Europe, 1955–58. This report follows the main lines of the last report on the fertiliser situation published in January 1957 and gives figures for production, trade and consumption of the three major plant nutrients and information on fertiliser prices. A final chapter is devoted to agricultural lime. Price 7s., $1.25 or 400 F. fr.

The latest publication in the series *The Main Products of the Overseas Territories* is *Oilseeds*, 1957, pp. 333 deals with the recent history of the production of oils and oilseeds and considers future prospects in the light of world economic conditions and the conditions in producing countries. Price 24s., $3.50 or 1,200 F. fr.

Other Publications

We have received copies of the following publications:

Papers read and discussed at the *International Refresher Course for Phytosanitary Inspectors* held at Munich, October 1957. The papers were concerned with phytosanitary inspection relating to plant products, fruit, potatoes, nursery stock, cut flowers and flower bulbs and contained special reference to San Jose scale, Mediterranean fruit fly and potato root eelworm. Published by EPPO, 142 Champs Elysées, Paris.

The Annual Report and Accounts of the Colonial Development Corporation. This is a public corporation established by the U.K. Parliament for the purpose of assisting colonial territories in the development of their economies. It has powers to borrow £150 million long-term and £10 million short-term outstanding at any one time. It is organised to operate commercially and is required to pay its way. The Directors of the Corporation are appointed by the Colonial Secretary, to whom they submit the annual report and accounts of its operations during the year.

Machinery and Equipment

The ' Danarm D.D. 8F ' has a tremendous cutting speed and is light and easy to handle

Effortless Sawing

A new direct-drive, petrol-driven chain saw – the ' Danarm D.D.8F ' – is offered by *J. Clubley Armstrong Danarm Ltd.* It is fitted with a specially designed Villiers engine with a diaphragm carburettor, which enables the saw to be used at any angle and even upside down, while the absence of a gearbox not only means a saving in weight, but also makes for improved design. The machine has a tremendous cutting speed and the chain travels so fast that cutting progress is automatic and effortless. Thus no pressure is needed; the machine just sinks smoothly into the wood by its own weight. If pressure is applied, it is claimed that the machine can stand a considerable overload without stalling.

This is a compact lightweight tool which is not only suitable for the country estate, but is sturdy enough for continuous heavy work in forest, jungle or plantation.

Versatile and Reliable

Since its introduction by the *Rover Co. Ltd.* in 1948, no less than 200,000 ' Land-Rovers ' have been produced and 150,000 of these have been sent to 150 different countries. The latest version of this already reliable and versatile vehicle has many new features designed to increase its appeal in world markets. The new Series II ' Land-Rover ' is an even better equipped and more powerful vehicle and driver and passenger comfort has been improved, making it equally as suitable for long-distance travel as for movement over rough country. The makers claim that with its four-wheel drive it can maintain good average speeds over sand and soft snow, or on roads with a covering of mud.

The new 4-cylinder 2¼-litre petrol engine develops no less than 77 b.h.p. and gives 25 b.h.p. more than the previous 2-litre engine; this will enable the vehicle to do difficult jobs with even greater ease than the old model. It has an improved turning circle and the fully-floating rear axles spreads the load over four hub bearings. Pendant pedals and the hydraulic clutch have been introduced to give better sealing against dust, sand and water. There are ingenious catches for securing the tailboard, even over the roughest ground, with at the same time quick and easy release, when so required.

The ' Land-Rover ' is suitable for survey teams working in difficult country; for managers of rubber, coconut, cocoa and sugar plantations; for forest officers; and for those responsible for the control of rivers and water supplies and the inspection and maintenance of irrigation canals. It may be used on the farm for towing cultivators, harrows, trailers, fertiliser spreaders, and even combine harvesters. Stationary, it can be used to power rick elevators, silage blowers, milking machines and engineering equipment.

320 Horse-power

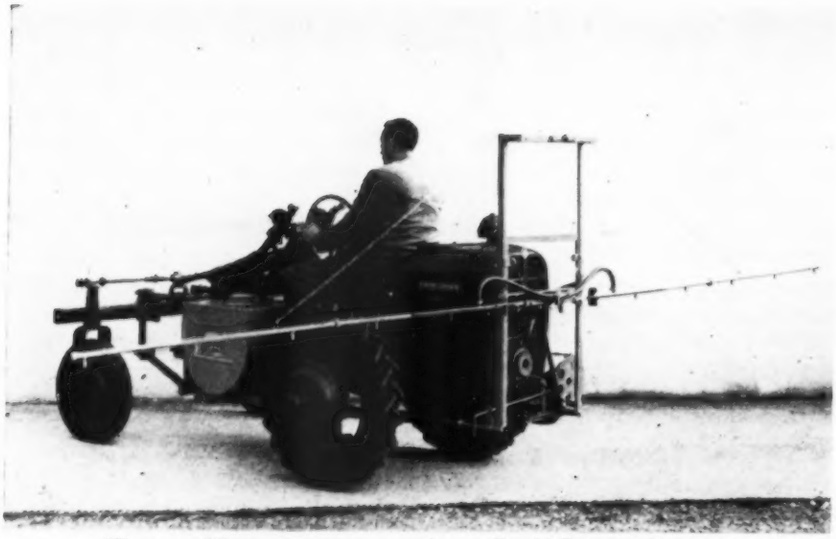
Caterpillar Tractor Co. Ltd. announce that their ' DW 20 ' and ' DW 21 ' rubber-tyred tractors have now been fitted with a 320-h.p. turbo engine and they will be known in future as the ' DW 20 ', series F, and ' DW 21 ', series D, tractors. There has also been a major improvement in the design of the air induction system so as to obtain higher operating efficiency over a wide range of altitude. The top speeds of these new models will be 22.6 m.p.h. and 35.8 m.p.h., representing an increase of 2.1 and 3.7 m.p.h. over the previous models.

Heavy-duty radiator guards have been fitted to both, and the ' DW 21 ', series D, has a special bumper fitted with readily accessible pull-hooks.

Feed Preparation Plant

The *ScotMec* hammer mill and feed mixer, fitted with their cyclonic filter box, makes an excellent combination for the milling and mixing of balanced rations for cattle. The limiting factor in any feed preparation plant is, of course, the output of the hammer mill; this new unit has a large-capacity self-emptying feed bin with an unchokeable feed regulator and the mills have output ratings of from ½ cwt. to 45 cwt. per hour. A striking feature in the design is the mounting

The latest version of the sturdy ' Land-Rover ' is more powerful and more comfortable



The new Allman sprayer mounted on a David Brown 2D tractor

of the motor on the base of this mixer, which gives stability and ease of access for necessary maintenance.

The cyclonic dust filter system allows the free release of warm humid air into the atmosphere through filter sleeves without any necessity for re-circulation, so that only cool air passes through the system. The bagging attachment is at a convenient height, is dustless in operation and each bag is filled in a few seconds.

' Livedrive '

The main features of the new David Brown 40-h.p. diesel tractor, the 900 ' Livedrive ', is the advanced design of the p.t.-o. and the hydraulic system.

With ' Livedrive ' a double-action clutch is provided to allow the main transmission to be disengaged without affecting the drive to the p.t.-o. (when using such equipment as combine-harvesters, balers and forage harvesters) or the hydraulic system (when operating with hydraulic loader or any implement with which it is required to change direction without disengaging the hydraulic lift system).

In the David Brown design, however, there are three separate and distinct phases in the disengagement of the clutch.

The first movement disengages the main transmission; the second phase of clutch pedal movement provides a ' neutral zone ' before the beginning of the third stage, *i.e.* disengagement of the hydraulic system. The provision of the extra intermediate stage ensures that clutch plate wear is reduced to a minimum.

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The Scotmec hammer mill and feed mixer is a compact and efficient unit

Compared with the normal ' 900 ' tractor, the standard production model, the ' Livedrive ' model differs in the following respects: chassis lengthened by about $3\frac{1}{2}$ in. to accommodate the double-action clutch; steering centralised; air cleaner repositioned to allow for fitting a front panel; tractor mainframe and front extension stiffened; grease bath steering box replaced by oil-bath type.

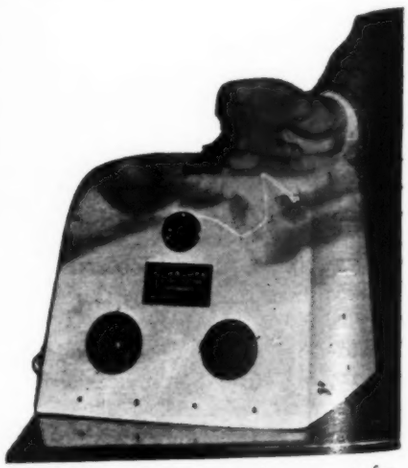
Tractor-mounted Sprayer

The new *Allman* medium- and low-volume sprayer, which has been specially designed for attachment to the *David Brown* ' 2D ' tractor, has a 50-gal. underslung tank. The unit is fitted with a $\frac{3}{4}$-in. ' Rollervane ' pump with a working pressure of up to 100 lb./sq. in., depending on the size of the nozzle used. The ' Genimec ' control valve which is fitted gives finger-tip control. The boom, which is in two parts, is fitted with breakaway and outrigger chains, the height being regulated by means of an adjusting slide. The overall spraying width is 18 ft.

The usual range of Allman accessories can be used with this unit, including hand lances, and special nozzles for hop spraying and fruit tree spraying may be fitted.

Seed Germination

The 'Vitascope', an instrument manufactured by the Foss Electric Co., of Denmark, is used by grain merchants and in malting laboratories to determine the germinating power of grain and seed. Previously the conventional germination analysis took from three to five days; now with this instrument it is possible to obtain an accurate indication in a few minutes. It works on the tetrazolium method, which is quicker and more reliable than any other. The grain does not need to be soaked, as the machine splits each grain into two exact halves.



The ' Vitascope ' is an instrument for measuring the germinating power of grain and seed

Agricultural Chemicals

Fungicides; insecticides; weedkillers; fertilisers; company bicentenary

200 Years

The firm of *J. R. Geigy S.A.* was founded in 1758, when Johann Rudolph Geigy set up in Basle in Switzerland as a merchant in dyes and pharmaceuticals. From modest beginnings, the organisation has since grown into a vast network of some 50 companies, operating in over 17 countries and this year the Geigy Organisation is proudly celebrating its bicentenary.

Johann Geigy (1733–93), founder of the firm which this year celebrates its bicentenary

It was the discovery of the DDT insecticides in the Basle laboratories that spread the fame of the company throughout the world and for his work, Paul Müller, head of the Geigy research team was awarded the Nobel prize for physiology and medicine in 1948. The story of the services rendered by DDT insecticides to human hygiene by controlling the insect carriers of typhus, malaria and yellow fever, has already been written into the history of our times.

The first DDT insecticides were put on the market under the trade name of ' Guesarol '; other chemical substances have since been added to the active ingredient to give a wide range of insecticidal preparations, such as ' Guesacopper ', ' Guesapon ', and ' Guesarex '. Potato, fruit and vine growers and market gardeners have found that these ' Guesarol ' products are highly effective against all the usual crop pests, while being harmless to human beings and animals.

The DDT product ' Neocid ' has been effective in preventing the spread of epidemic diseases, such as typhus, in southern Europe and it is now widely used in a variety of formulations in tropical and sub-tropical countries. The active ingredient is also used in ' Trix ' for giving wool temporary protection against moths and beetles and the ' Bosan ' products are used for protecting timber against woodworm, deathwatch beetle and other pests.

When reports were received that houseflies were beginning to show unexpected resistance to DDT insecticides, new formulations were developed, and it was found that a compound, diazinon, when added to the ' Guesarol ' preparations made them effective against the resistant flies.

Recently the firm has been concentrating on the search for insecticides that would be toxic only to a certain species of insect. Thus ' Primin ', a formulation based on the active ingredient isolan, is lethal to aphis, but spares beneficial insects. ' Folbex ' smoke papers can be used to fumigate the inside of a beehive without injuring the bees, as their toxic action only affects the mites responsible for the acarine disease which can cause such devastation within the hive.

' Mesulfan ' is a new fungicide which gives good control of scab, cherry canker, mildew and other fungus diseases on fruit trees and vines, without injury to the fruit or hazard to the associated bees. ' Tomorin ' likewise is a rodenticide which deals with rats and house or field mice and yet is harmless to man or domestic animals, if used with normal precautions.

Another product of interest to agriculturists is ' Kik ', an insect repellant, which when applied to the skin effectively keeps off midges and horseflies, and then there is ' Triblanc Geigy ', an insecticidal whitewash for spraying on the walls of cowsheds to keep flies away.

In the field of pesticides, *Geigy and Fisons* are now collaborating on a world basis in research, development and distribution.

Apple and Pear Scab

'AAteck ' or TEC is a new development in the field of dithiocarbamate derivatives, produced by *N.V. AAgrunol Chemische Fabrieken (Holland)*, especially for the control of apple and pear scab, *Venturia* spp. It has also given some control of powdery mildew, *Podosphaera leucotriche*. It can be used as a whole-season spray from pre-bloom until harvest and, according to the manufacturers, is especially suitable for spraying young orchards.

A Miticide-ovicide

The problem of spider mites on fruit and nut trees presents a complex picture of balances and upsets brought about by predators, insecticides and the weather. The *American Potash and Chemical Corporation* claim that their product ' Estonmite-50W ' will help to preserve a more satisfactory equilibrium because it is designed specifically for mites and no harmful effects on predator populations have yet been recorded; it is also effective under most weather conditions and for a long period after application.

The active ingredient in this product is p(chlorophenyl) p(chlorobenzene) sulphonate, which attacks the ever-recurrent mite population at its source —the eggs. It actually kills the eggs but it also prevents hatching mites from living long enough to become established.

This selective formulation is a

powder, which is dustless, non-abrasive and rapidly wettable; it keeps in suspension and gives good coverage. It is compatible with most organic insecticides and non-alkaline inorganic materials. It has a low toxicity to warm-blooded animals.

Weeds in Grassland

In recent years, a complete change has come about in the attitude of the farmer towards his grassland; grass is now looked upon as a crop in its own right, requiring to be correctly managed. At one time it was thought that grass was the one crop which could be cut and grazed almost indefinitely without needing very much in the way of fertiliser treatment. The rising cost of compound feeding stuffs has made it necessary to conserve more grass and get better value from grazing. There are three main factors which have been responsible for the tremendous increase in the quality and productivity of grassland in Britain since the war. These are fertilisers (especially nitrogenous fertilisers), the use of improved strains of grasses and clovers and the application of growth-regulator selective weedkillers.

A useful booklet has just been produced by *May & Baker Ltd.*, entitled ' Selective Weedkillers for Weed Control in Grassland ', which discusses the economics of this aspect of grassland management, describes the method of treatment of permanent pastures, temporary leys and rough grazing land and includes notes on the commonest weeds ; this may be obtained free on application through our Reader Service.

Better Blight Control

No control measures can cure potato haulm already infected with blight. To ensure that the crop is properly protected, the first application of *Bayers* ' Zineb ' should be made just before the haulms meet in the row and thereafter there should be three further sprayings at intervals of ten days. The makers claim that not only does this give thorough protection from the disease but in addition the gentle action of the product allows the haulm to grow on unchecked and give a full harvest of healthy tubers.

Through the employment of the latest techniques, the manufacturers have succeeded in producing a material of the smallest particle size,

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stability and dispersibility. This makes it particularly suitable for aerial spraying which requires an extremely low volume of application per acre. It is described as a free-flowing cream-coloured powder which mixes easily with water; it is non-corrosive, non-clogging and no special safety precautions are required. It can thus be used in any low or high volume ground spraying machine.

New Concentrated Fertilisers

Two new compound fertilisers are announced by *Fisons Ltd.* They contain an improved balance of plant foods with a greater content of potash for which a need was shown to exist as a result of recent work at the Levington Research Station. They are known as fertilisers ' 45 ' and ' 47 ' and they are further additions to the ' 40 ' range; they will provide water-soluble plant foods at lower unit-cost than less concentrated plant foods.

The compounds are stated to have the following analyses:

Fisons ' 45 ': 6% N, 15% P_2O_5, 15% K_2O.

Fisons ' 47 ': 14% P_2O_5 and 28% K_2O.

Fisons ' 41 ': 10% N, 10% P_2O_5, 18% K_2O.

In addition the ' 40 ' Range incorporates the insecticide aldrin and the trace element boron.

Fertiliser ' 45 ' is for autumn cereals and autumn grazing; the ' 47 ' is for autumn cereals not requiring nitrogen and for the autumn treatment of grassland, lucerne, peas and beans and the ' 41 ' with its improved potash content is for spring cereals, maincrop potatoes, sugar-beet and grassland.

Data on Insecticides

The 1958 edition of ' Physical Properties of Synthetic Organic Chemicals ' is a handy 28-page booklet giving data on the physical properties of more than 350 organic agricultural chemicals. Copies of the booklet (RF-6136) may be obtained free through our Reader Service.

Fifty new chemicals have been introduced by Union Carbide since the previous edition. Viscosity index improver D and ' Crag Sevin ' experimental insecticide are two of the new products described in the section on chemicals for special applications.

Soluble Solid Fertilisers

A concentrated fertiliser containing the better-known major plant nutrients, nitrogen, phosphorus, and potash, together with magnesium, is offered by *F. W. Berk & Co. Ltd.* The constitution of this mixture, which is soluble in water, is 18% N, 18% P_2O_5, 21% K_2O, and 1.25% MgO. This complete mixture may be scattered over the ground or around the root area at the rate of 1 oz. per sq. yd., or the same quantity may be dissolved in three gallons of water, and applied by watering can, or it may be prepared in concentrated solution for use in irrigation equipment with a 50 times dilution. The concentrations and the method of application can, of course, be varied to suit different crops and different conditions.

Control of Sisal Weevil

Aldrin and dieldrin have given good results in the control of sisal weevil, *Scyphophorus acupunctatus*. This pest, which until a few years ago was confined to the sisal-growing areas around Tanga, has spread rapidly until it is now to be found throughout Tanganyika, but as yet it has not reached the Kenya highlands. Nursery plants are particularly liable to larval attack, especially in years of high rainfall, and it is important that control measures should be taken against them to avoid transplanting infested material into the field.

Trials at the Sisal Research Station, Tanganyika, indicate that the application of ½ lb. of active dieldrin per acre is the best method for the control of weevil in nurseries, the application being made shortly before planting and when the topsoil is dry. ' Dieldrin ' 15 can be used for spraying transplants in the field but better results have been obtained from the application to the planting holes of aldrin wettable powder, according to ' Span ' the new *Shell* publication.

World Crop Reports

Smaller barley and oats crops

INTERNATIONAL REPORT

Barley and oats

Forecasts of a smaller 1957 world crop of barley and oats than in 1956 have been confirmed by the latest information available. Present estimates place the two crops combined at 139 million short tons. At that figure the total for the two crops is about 7% less than the record 1956 production, but is still above the 1950–54 average.

Reduction from the 1956 record level was divided almost equally between barley and oats. The estimated total of 3,120 million bushels of barley, though 8% less than in 1956, is 16% above the 1950–54 average. Reductions indicated from the 1956 output were greatest in the *Soviet Union*, *Europe* and *Africa*. Lesser reductions in *Australia* and *South America* were offset by increases in *North America* and *Asia*. Barley acreage in 1957 was less than in 1956 and yields were also smaller.

World production of oats is now estimated at 4,000 million bushels. This is 6% less than in 1956 and 4% below the 1950–54 average. Compared with last year's harvest, the bulk of the reduction was in Europe, the Soviet Union and Australia. Reductions in South America, Africa and Asia were moderate and the total for North America shows little change from the 1956 figure. World acreage of oats was relatively very small – 118 million acres compared with 122 million a year ago and the 1950–54 acreage of 129 million.

North America's barley production of 664 million bushels is slightly larger than in 1956 because of an increase of 59 million bushels in the U.S. crop. This more than offset a reduction in Canada and a slight decrease in Mexico. The smaller output in Canada was due to low yields – 23.4 bushels per acre compared with 32.1 last year. Canada's barley acreage was one million acres more than in 1956. U.S. acreage was also larger and yields were about the same as the 1956 average.

Production of oats in North America was 1,696 million bushels, virtually the same as the production a year earlier. A substantial increase in the U.S. balanced a sharp cut in Canada's output. The U.S. production of 1,308 million bushels was 145 million bushels more than the small crop a year ago. Both acreage and yields were up in 1957. The average of 37.4 bushels per acre was second to the all-time record of 38.3 bushels in 1955. Canada's production of 385 million bushels of oats compares with the 524 million bushels produced last year. Yields averaged only 34.9 bushels per acre compared with 44.8 bushels in 1956. Acreage was only slightly less than the large acreage last year.

Production of these grains in *Western Europe* was much smaller than in 1956. The reduction was especially sharp in oats; the 1957 total of 895 million bushels contrasts with 1,078 million in 1956. A substantial cut in acreage, together with smaller yields in most countries, accounted for the reduction. The largest single change was in France, where production was 41% less than in 1956. A sharp cut from the abnormally large acreage last year and substantially smaller yields this year account for the reduction.

Oats acreage in Western Europe was 2.1 million acres less than in 1956. France's acreage in oats dropped about 1.6 million acres. Reductions in a number of other countries of the area were partly offset by gains in a few countries, especially in the United Kingdom.

Barley production in Western Europe is estimated at 766 million bushels. This is 73 million bushels less than in 1956. The reduction is due to a cut in acreage. The acreage reduction was especially marked in France, where a large part of that country's damaged wheat acreage was shifted to spring barley last year. That brought the barley acreage to 5.7 million acres in 1956, an unprecedented level. Barley yields in Western Europe in 1957 were only slightly less than the good yields in 1956.

Production of these grains in *Eastern Europe* is larger than the small 1956 harvest there. The barley crop is now estimated at 254 million bushels, compared with 221 million bushels a year earlier. Acreage was larger and yields higher than in 1956 for most countries of the area.

The area's crop of oats is estimated at 385 million bushels, 33 million larger than in 1956. Most of the increase is attributed to increased acreage. A total acreage of 9.4 million acres compares with 8.8 million a year earlier and the 1950–54 average of 9.7 million. Yields were only slightly above those of 1956.

A substantial reduction in the *Soviet Union's* acreage in these grains and an indicated drop in yields bring tentative estimates of production to the lowest level of recent years. The reduction is especially marked for barley with 1957 production estimated to be about 375 million bushels, compared with 525 a year earlier. Oats production of about 800 million bushels compares with an estimated 875 million bushels in 1956.

Asia's production of barley is estimated at 865 million bushels, 25 million above the 1956 total. The largest single gain is in Turkey, where an increase of 30 million bushels is reported. Substantial increases reported for Iran and Iraq were offset by reductions in other countries of the area. Production of oats in Asia is estimated at 105 million bushels, slightly less than in 1956.

Barley production of 90 million bushels in *Africa* is about 40% less than the large 1956 crop. Sharp reductions are reported for both Algeria and Morocco, which together normally account for about 75% of that continent's total. Barley acreage was smaller in each of the countries, especially in Morocco, and yields were well below average. Production of oats was about 10 million bushels, slightly less than in 1956.

South America's production of these grains was moderately lower than in 1956. Barley production is estimated at 75 million bushels, compared with the large harvest of 87 million a year earlier. Lower yields in Argentina account for most of the decline. Production of oats is estimated at 80 million bushels, compared with 92 millions in 1956 and the 1950–54 average of 67 millions. A drop in Argentina's crop is the only significant change.

Sharply reduced crops of barley and

oats in *Australia* bring Oceania's totals to the lowest point of recent years. Extended drought over the eastern part of Australia reduced all grain crops to a very low level. Barley production is estimated at 30 million bushels, compared with 52 millions in 1956. Yields averaged 15 bushels per acre, compared with 23.9 a year earlier. Production of oats was 29 millions, compared with 53 millions in 1956.

REGIONAL REPORTS

Canada

Output of *maple* products (expressed as syrup) in 1957 rose to 3,134,000 gal. from the preceding year's 2,677,000 and the 1950–54 average of 2,626,000 gal.

Production of maple syrup last year increased to 3,068,000 gal. from 2,618,000 in 1956. Maple sugar output rose to 661,000 lb. from 586,000.

Japan

Unseasonably cold weather in late March caused extensive damage to Japan's 1958 *grain* crops, according to recent reports. The Ministry of Agriculture and Forestry estimated the damage as the greatest since World War II.

Damage from the cold was widespread, with more than 50% of the acreage planted to wheat, common barley and naked barley suffering to some degree. Advanced growth of these crops, following warm weather, made them more susceptible. Preliminary estimates placed production losses at 15% for wheat, 17% for common barley and 7% for naked barley.

Greece

Rice acreage in Greece now being planted is expected to be slightly larger than a year ago. Several reasons for the increase are given: (1) prices to growers are satisfactory; (2) production costs are decreasing as more land is irrigated; (3) domestic production does not meet requirements; (4) prices of imported rice are higher than for domestic rice; and (5) demand for rice seed is good.

The seed production service of the Ministry of Agriculture has provided growers with about 1,790,000 lb. of improved seed, compared with 1,100,000 lb. in 1957. With the exception of 6,600 lb. of 'Bersani', the seed is 'Americano', which is well adapted to local soil and climate. The seed provided is very popular with growers.

The 1957 crop was around 130 million lb. of rough rice, 25% more than in 1956. Thus the downward trend in rice acreage since 1954 was halted. Expansion prior to 1954 was partly speculative, and when prices declined growers reduced acreage.

Mexico

The 1957–58 *tobacco* crop is forecast at 80.9 million lb., significantly larger than the 1956–57 crop of 73.6 million lb. This is the second successive year of larger crops since production dropped sharply to 63 million lb. in 1955–56.

Production of light types will be higher in 1957–58 than last season, but still below the 52 million lb. in 1954–55. This season's crop of flue-cured is forecast at 3.5 million lb. and Burley at 1.8 million, slightly above last season. Other light air-cured types are expected to increase from 37.7 million lb. in 1956–57 to 44.1 million in 1957–58. The remainder of the 1957–58 crop, 31.5 million lb., will be dark air-cured leaf.

Panama

Banana exports for 1957 are stated to have reached the record figure of 7.4 million bunches, not including exports from Bocas del Toro.

The *rice* and *maize* harvest showed a loss during the year due to the lack of rain and facilities for water. It was stated that the production of certified rice seed produced in the Republic had doubled since 1956. Sowing with this seed was expected to begin in the New Year.

The Institute of Economic Development is said to be studying the question of constructing 1,000 water wells to be operated by windmill in those regions where there is a scarcity during the dry season.

The *tomato* crop is estimated at 12 million lb.

Drought reduced Panama's 1957–58 *rice* crop 12% below production in 1956–57, even though acreage increased 4%. Output is tentatively estimated at 190 million lb. of rough rice (124 million lb. milled), about 22 million lb. (14 million lb.) less than in the year before. The provinces most affected were Cocle, Herrera, Los Santos and Veraguas.

England and Wales

The weather in May was changeable and rather cool. During the first half of the month cloudy weather with slight rain, except where thunderstorms occurred, gave place to intermittent showers and high winds. A short spell of warm weather in mid-month was followed by showers and sunny periods. Unsettled weather returned during the last few days, bringing heavy rain in places.

Autumn-sown wheat was generally satisfactory and had made good growth; mildew was occasionally reported. *Spring-sown wheat*, although slightly backward, looked promising; wireworm and leatherjacket damage was reported from some districts. *Autumn-sown barley* was looking well, but mildew was reported from some districts. *Spring-sown barley* was a promising crop, but yellowing, pest damage and heavy weed infestation were reported from some areas. *Autumn-sown oats*, on the whole, were satisfactory. *Spring-sown oats* were fairly satisfactory, although growth had been retarded in some areas. *Mixed corn* looked well on the whole. The small acreage of rye was very satisfactory. *Winter beans* for stock-feeding continued to make good progress. *Spring beans* made rather slow growth in some areas, but were generally satisfactory. *Peas* for stock-feeding also made rather slow growth, but were fairly satisfactory. *Early potatoes* made steady growth during May, but it was considered that liftings might be later than normal in some districts. Second early and maincrop varieties were backward in many areas, but appeared satisfactory.

Germination of *sugar-beet* was satisfactory, but rather slow. Crops were making strong growth and singling was well forward in several areas. In most areas the sowing of *mangolds* was complete. Irregular germination was reported from some districts and growth had been slow generally. Sowing of *turnips and swedes* progressed in many areas and germination and growth were generally satisfactory for early-sown crops. Germination and growth of early-sown *kale* had also been good on the whole, but a considerable acreage remained to be sown.

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